APPENDIX TO
EXHIBIT #17

Royal Commission

on the

NEW BRUNSWICK

COAL MINING INDUSTRY

final report

Fredericton, N.B. February, 1960

FINAL REPORT

To His Honour the Lieutenant-Governor in Council,

MAY IT PLEASE YOUR HONOUR,

We, the Commissioners, appointed as a Royal Commission in accordance with the terms of an Order in Council dated 29th April, 1958, to study and report upon the coal resources of the Province and their future utilization and development:

Beg to Submit to your Honour the following Final Report.

W. Y. Smith, Chairman

Alexander Tooke

Mathias Wuhr

D. W. Gallagher
Secretary

February 25, 1960

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THE HONOURABLE THE PREMIER REPORTS FOR THE INFORMATION OF THE COMMITTEE OF THE EXECUTIVE COUNCIL:

That it is desirable that a study be made of the coal resources of the Province and their future development and utilization,

The Honourable the Premier RECOMMENDS that a Commission issue under the Great Seal of the Province under the provisions of Section 2 of The Inquiries Act, Chapter 112 of the Revised Statutes of New Brunswick, 1952, to

William Y. Smith, Fredericton, Chairman,

Alexander Tooke, Minto, Member,

Mathias Wuhr, Minto, Member,

and that the duty of the said Commission shall be to study and report to the Government of New Brunswick concerning the coal resources of the Province and their development and utilization including, but in no way limiting the generality of this reference, the following matters:-

(1) The desirable level of annual output, considered both from the standpoint of coal reserves and the general welfare of the industry and the community in which it is located.

(2) The relationship between shaft mining and strip mining in the years ahead and its implications for the volume of employment offered by the industry.

(3) Probable trends in total costs per ton for New Brunswick coal as contrasted with other fuels.

(4) The probable future demand for New Brunswick coal from markets both within and without the Province.

(5) The nature of the present labour force employed by the industry and the availability of labour in the future.

(6) The present means of marketing New Brunswick coal and the method of price determination.

(7) The present status of the coal mining industry in relation to the provincial economy and the contribution that it should make to economic growth in the future.

(8) The determination of the extent and nature of coal reserves.

And the Committee of Council concurring in said Report and Recommendation,

IT IS ACCORDINGLY SO ORDERED.

(Sgd) D. L. MacLaren

This is to certify that the foregoing is a true copy of an Order of the Lieutenant-Governor-in-Council of the Province of New Brunswick, made on the 29th day of April, 1958.

H. Lester Smith
A/Clerk of the Executive Council.

SUMMARY OF THE REPORT

The General Background

Since the end of World War II, the New Brunswick coal mining industry has been marked by two predominant developments:- output has risen sharply and strip mining has become the principal method of extraction. In 1945, the total output of the field was 347,601 tons. In 1959, output attained the record level of 993,821 tons. By 1947, roughly half of output was produced by shaft mining and half by strip mining. In recent years, over eighty per cent of total output resulted from strip mining and less than twenty per cent from shaft mining. The production figures for 1959 show 813,907 tons produced by stripping and 179,914 by underground operations.

Strip mining entails the use of large draglines and relatively small amounts of labour, and thus production per man-day is much higher than is shaft mining. In 1959, although 572 men were employed in stripping and 460 in shaft mining, the ratio of strip production to shaft production was 4.5 to 1. Output per man-day in stripping was 5.4 tons and 1.8 in underground production.

The Commission estimates that approximately 6,000 people in New Brunswick are dependent on the coal industry for a livelihood. Most of these people reside in the Minto-Chipman area. The Commission believes that this area is too dependent on one industry and that an attempt must be made to bring in new industries. A pulp mill, located on Grand Lake, would, in itself, provide the required industrial diversification.

Coal Reserves

A detailed survey conducted by the staff of the provincial Department of Lands and Mines at the request of the Commission, computed recoverable coal reserves in the Minto area at approximately 42 million tons. This figure was compiled primarily from information obtained from the test-holes of coal companies. Assuming that coal deposits to a depth of eighty feet can be extracted by strip mining, reserves can be divided into 24.5 million tons which can be recovered by stripping, and 17.5 million tons which can be obtained by shaft mining methods. Possible additional reserves are estimated at 20 million tons.

The Commission recommends that an effort be made to keep the output of the field between 850,000 and 1,100,000 tons a year. Output below 850,000 tons would create a serious amount of unemployment, and output appreciably above 1,100,000 would result in coal deposits being depleted at too rapid a rate. In addition, the Commission recommends the formation of a New Brunswick Coal Industry Advisory Board composed of representatives of the Provincial Government, coal producers and the miners' union. The task of this Board should be to keep detailed information on coal reserves up-to-date, adjust minimum and maximum production figures as circumstances change, prepare market forecasts, and generally to seek solutions to the industry's problems before they reach critical proportions.

Production Problems and Mining Methods

At the present time, production costs of shaft mined coal in the Minto area are relatively high and the margin of profit is small.

In general, costs of strip mined coal are substantially lower. As it becomes necessary to utilize still larger draglines and to remove greater quantities of overburden to recover deeper coal, the costs of strip mining will invariably rise.

In the years immediately ahead, New Brunswick coal will be meeting intensified competition from other fuels, primarily residual oil. Thus it is essential to increase productivity per man in shaft operations if important markets are to be retained. Representatives of Local 7409, the United Mine Workers of America, and Mr. Victor McMann, a coal producer, recommended in their briefs to the Commission that shaft operations be mechanized.

In 1957, a New Brunswick delegation visited West Germany to examine methods of thin seam mining. Members of this delegation reported to the Commission that conditions in some mines in the Ruhr Valley were very similar to those in the Minto area, and they suggested that a German mining engineer be brought to New Brunswick to advise on the possibilities of underground mechanization.

The Commission were fortunate in obtaining the services of Mr. Franz Tiefengraber, a German coal mining engineer, who had impressed the New Brunswick delegation with his knowledge of thin seam mining when they met him in Germany. Mr. Tiefengraber spent two months in Minto last summer and prepared for the Commission a comprehensive report on the possibilities of underground mechanization. In summary, he reported that four of the five shafts operating in the Minto area could be mechanized so as to increase substantially output per man shift.

Mr. Tiefengraber's report is discussed in detail in Chapter III and is published in full as Appendix I. In September, 1959, Mr. W. P. Dryer, the thermal power consultant of the New Brunswick Electric Power Commission and an engineer with considerable experience in coal mining, studied the Tiefengraber report for the Commission and visited thin seam mining operations in the Ruhr Valley in West Germany. Mr. Dryer furnished the Commission with a most favourable report and this is published as Appendix II. The Commission has also given this report most careful study and have discussed it with a great variety of people with knowledge of coal mining in the Minto area. The opinion of the Commission, and the consensus of the advice that the Commission has received, is that underground mechanization opens up new possibilities for the New Brunswick coal industry. Accordingly, the principal recommendation of this report is that the New Brunswick Government co-operate with the New Brunswick Coal Producers Association, Local 7409 of the United Mine Workers of America and the New Brunswick Electric Power Commission in conducting a trial mechanization operation. That is, a longwall face should be set up in one of the Minto shaft operations and mechanized mining given a thorough trial. The costs of such a trial will not be high and benefits which could accrue to New Brunswick and the provincial coal mining industry could be very great indeed.

The Commission believes that there is every possibility of mechanized underground mining bringing about substantial reductions in the cost of shaft mined coal so that production can expand in the future. The investment in machinery and equipment required for one operation, with two longwall faces, is approximately $200,000.

The successful mechanization of shaft operations would, in itself, solve a whole complex of problems:- it would bring a great improvement in underground working conditions, enable new markets to be opened for New Brunswick coal, and promote the stability of income and employment in the Minto area.

Future Market Trends

Throughout practically the whole of the Western world, coal is meeting intensified competition from oil. This is due, primarily, to two factors:- (1) the recent discovery and exploitation of new sources of crude oil in areas ranging from the Canadian West, to the Sahara, to the Middle East; (2) the trend towards greatly increased carrying capacity in oil tankers is bringing about economies in the cost per barrel of moving oil. As a result, coal markets in areas adjacent to coastal waters are becoming increasingly vulnerable. At the present time, in Great Britain, the National Coal Board is holding an enormous stock pile of coal and is cutting back production. In West Germany, the loss of coal markets to oil is causing substantial unemployment in the Ruhr. In Nova Scotia, the problem of markets becomes increasingly serious.

In New Brunswick and the Maritimes generally, the competition of coal versus oil will be sharpened by the coming into production of the new oil refinery at Saint John. This, then, is the general background which must be taken into consideration in attempting to assess future trends in the demand for New Brunswick coal.

Historically, the New Brunswick coal mining industry developed to meet the needs of the provincial economy and 85 to 90 per cent of total

output has always been sold within the Province's boundaries. The major consumers are the pulp and paper mills in Northern New Brunswick and the New Brunswick Electric Power Commission. In recent years, substantial tonnages have been exported to one pulp mill in Maine and also to pulp mills in North Eastern Quebec. Thus, a large proportion of New Brunswick coal is sold to a few large purchasers and the loss of even one or two of these markets would have serious repercussions on the entire industry. Several of these large purchasers, located in areas where residual oil can be brought in by tanker, have indicated to the Commission that they could make substantial savings by converting from coal to oil. If these markets are to be secure, coal prices must be reduced. As has been stated above, the shaft mined coal is the higher cost coal and the Commission believes that substantial economies can be effected through underground mechanization.

As regards the New Brunswick Electric Power Commission, if the new 50,000 K.W. thermal plant at East Saint John burns oil, the demand for coal by the Commission will be substantially reduced through to the end of 1961. After that time, for a number of years, the demand for coal may be stabilized at approximately 150,000 tons a year.

The next two years could well be a critical period for the coal industry. Coal will be meeting intensified competition from oil and, it is hoped, shaft mines will be converting from handpick methods to mechanization. After that time, the growing demand for coal for industrial uses and for thermal power generation could be pushing output up towards the maximum level which has been recommended above. This will

certainly be the case if mechanization brings forth some of the high productivity figures stated in the report published as Appendix I.

Coke and Non-Fuel Uses for Coal

The Commission reviewed the possibilities of using New Brunswick coal to produce coke and examined the opportunities of utilizing New Brunswick coal deposits as the basis for a chemical industry. In the future, if a thermal type blast furnace zinc smelter is established in the Province, a considerable market for a locally produced coke would become available. There seems little opportunity for developing a chemical industry based on New Brunswick coal due to the cheapness and availability in Canada of natural gas and oil.

The Commission concludes that it would be unrealistic to assume that significant new uses will develop for New Brunswick coal in the near future. The demand will arise primarily from the present uses:- thermal power generation, process heating and space heating.

The Possible Need for an Interim Subvention for Shaft Mines

If the trial mechanization proves successful, it would take approximately two years for mechanization to become general in the Minto area. During this transition period, if there is danger of markets being lost, the Federal Government should be asked to grant an interim subvention on shaft mined coal. The terms of this subvention could be similar to that presently applying on Maritime coal which is used for thermal power generation.

Federal Subventions on Coal Movements

Since Federal coal subventions were first adopted in 1928, the basic aim has been to make Canadian coal competitive with American coal in markets in Central Canada. Under the 1959 regulations governing coal subventions, rates reflect accurately the competitive position of New Brunswick coal in certain areas around Quebec City. This recognition of the particular qualities of New Brunswick coal establishes an important principle. It should be recognized in all future changes in subventions.

SUMMARY OF RECOMMENDATIONS:

(1) An effort should be made to bring new industries into the Minto area so as to promote industrial development and diversification. A program of federal fiscal incentives would be of great assistance to areas like Minto in the Maritime Provinces. ....see page 34

(2) Output for the Minto area should be stabilized within a range of 850,000 to 1,100,000 tons a year. ....see page 43

(3) A New Brunswick Coal Industry Advisory Board should be established to promote the welfare of the industry. ....see page 44

(4) The present situation as regards the pattern of coal licenses and leases should be reviewed by the Department of Lands and Mines and an attempt made, in co-operation with the holders of mining rights, to develop a pattern which will be conducive to the highest possible level of coal recovery. ....see page 48

(5) The following recommendations are made in regard to stripping operations:- (i) old highwalls should be reduced to an angle of slope of 40 degrees where a hazard exists; (ii) where stripping is conducted near residential areas, the highwall should be enclosed by a temporary fence and no trespassing signs erected; (iii) before Crown Land is stripped, coal operators should be required to pay to the Crown the assessed value of the damages to the land. ...see pages 49 - 50

(6) The Government of New Brunswick should co-operate with Local 7409, the United Mine Workers of America, the New Brunswick Coal Producers Association and the New Brunswick Electric Power Commission to carry out mechanized shaft mining on a trial basis. An experienced and qualified

coal mining engineer should be retained to supervise this operation. pp. 68-69

(7) Coal producers should negotiate with owners of existing washing plants to have their coal washed on a custom basis. ....see page 69

(8) If mechanized underground mining proves successful, the New Brunswick Electric Power Commission and Provincial Government development agencies should consider the location of a large thermal generating plant in conjunction with a pulp mill in the Grand Lake area. ....see page 92

(9) Consideration should be given by coal producers to the development of markets in Maine and the New England states generally. ....see page 92

(10) The industry should expand its sales promotional activities in order to more fully develop the local market for Minto coal. ....see page 92

(11) The New Brunswick Electric Power Commission should purchase coal on a tender basis and every effort should be made to expand coal storage facilities at power plant sites. ....see page 93

(12) A measure of preferential treatment should be extended by the Provincial Government to the New Brunswick coal industry in purchasing its fuel requirements. ....see page 93

(13) The possibilities of utilizing coke from New Brunswick coal should be kept under review by the Department of Lands and Mines and the Federal Department of Mines and Technical Surveys should be requested to carry out such tests as may be necessary. ....see page 96

(14) The Department of Lands and Mines should require all coal producers to provide adequate wash house facilities for miners within a reasonable period of time. ....see page 103

(15) The New Brunswick Coal Producers Association, Local 7409, United Mine Workers of America, and other interested groups should consider making a joint effort to provide ambulance services in the Minto area. ....pp. 104

(16) Should shaft mines be confronted with serious market losses before a program of mechanization can be completed, representations should be made to the Federal Government for a special subvention on an interim basis.pp.107

(17) The present subvention covering the movement of New Brunswick coal to certain areas in Quebec reflects, for the first time, the particular qualities of New Brunswick coal. It is essential that this principle be recognized when future changes in subvention rates are under consideration.

....see pages 92 and 114

PREFACE

In preparing this report, we have endeavoured to forecast the problems which will confront the New Brunswick Coal Mining Industry in the decade 1960-1970 and to make recommendations which give promise of providing solutions. Any type of forecasting is a highly uncertain activity, and all we can claim is that we have given the problems, as we see them, intensive study and have endeavoured to seek out the best advice available before completing this report.

Canada and, indeed, the whole Western world is passing through a period of rapid technological change. We, in New Brunswick, must adapt those changes to our needs. In the shaft mining of coal, important developments have taken place in recent years and further changes appear to be under way. Our studies have lead us to believe that new methods of underground mining can bring great benefits to the coal industry and the whole provincial economy. Thus, our principal recommendation is that these new methods be given a thorough trial.

In the preparation of this report, we have had assistance from a great variety of individuals and organizations. The following made written submissions to us:- the New Brunswick Electric Power Commission, the New Brunswick Coal Producers Association, Local 7409, sub-district 7, United Mine Workers of America, the Avon Coal Company Limited, D. W. & R. A. Mills Limited, V. C. McMann Limited, and the New Brunswick International Paper Company.

Mr. C. S. Clements, Director of Mines, Department of Lands and Mines, and his staff have assisted us in every way and have done a great

deal of work on our behalf. We have been most impressed by the interest and efficiency of the Provincial Department of Mines. In addition, Mr. R. E. Tweeddale, General Manager of the New Brunswick Electric Power Commission, and his staff have compiled considerable information for us and have aided us with their experience as a major purchaser of New Brunswick coal. We should like, in particular, to thank Dr. H. J. Rowley, of the Commission's staff, for his assistance with Chapter five on:- "Coke and Non-Fuel Uses for New Brunswick."

Officials of the Dominion Coal Board have been most helpful and we owe a special debt to Mr. C. L. O'Brian, Assistant to the Chairman. Mr. W. P. Dryer did most valuable work for us during his visit to West Germany last September and we extend to him our sincere thanks. In addition, we would like to especially thank Dr. Jean Hubener of the University of New Brunswick for her valuable assistance in the translation of the many documents and reports which were available only in the German language. And finally, we feel that we were most fortunate in having Mr. D. W. Gallagher as our Secretary, Mr. R. A. Manzer as our Research Assistant and Mr. Franz Tiefengraber as our Technical Consultant.

CHAPTER I HISTORICAL BACKGROUND

(1) The Development of the New Brunswick Coal Mining Industry

Bituminous Coal has been mined in New Brunswick for more than three centuries. Massachusetts colonial records indicate that coal was being shipped to Boston from the Grand Lake basin as far back as the year 1639. In the entry to his Diary for September 8, 1667, Samual Pepys indicates a knowledge of the Grand Lake coal area when he refers to: "Nova Scotia, which hath a river 300 miles up the country, with copper mines more than Swedeland, and Newcastle coals, the only place in America that hath coals that we know of." The mention of the "River", obviously the Saint John, and "Newcastle coals" in the same sentence suggests that Pepys was aware of the coal resources of the province and considered them valuable.

Despite these early beginnings, the coal industry in New Brunswick was to remain of little importance for another two centuries. No reference to the Grand Lake coal basin in the eighteenth century can be found; but a small industry, overshadowed as it must have been by fishing and lumbering, was developing nevertheless. In the First History of New Brunswick, published in 1825, Peter Fisher writes as follows:

> The country in the vicinity of Grand Lake abounds with coal, which is found of good quality, particularly at a creek called New-Castle, where large quantities have been dug. A stratum is generally found near the surface of the earth: the first layer of coal being about eighteen inches in depth, and they are found to improve in quality in proportion to the depth of the veins. The layers are nearly horizontal, and are probably a continuation of the strata found at Cape Breton, which has been ascertained to proceed in a Southwestern direction from that island, (into) Nova Scotia and New Brunswick.

Fisher also reports that 749 tons of coal were exported from the province in 1824 through the port of Saint John. At the same time, it was


NEW BRUNSWICK COAL PRODUCTION 1887- 1958
SOURCE : THE CANADA YEARBOOK
OUTPUT IN THOUSANDS OF TONS
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
ESTIMATE
1959

necessary to import 5,242 chaldrons of coal (a chaldron is equal to 2,800 pounds) in order to meet local needs.

In his massive work, Acadian Geology, J. W. Dawson lists the quantity of coal which was raised at Grand Lake in various years in the period from 1825 to 1864:

1825	66	chaldrons	1835	3,537	chaldrons
1830	70	chaldrons	1838	2,143	chaldrons
1833	138	chaldrons	1864	5,000	chaldrons
1834	687	chaldrons			

Dawson's listed output for 1825 fails to correlate with the export figure given by Fisher for the preceding year, but the explanation may be that some Nova Scotia coal was also being exported through Saint John during this period. In any event, Dawson's table does indicate that the coal mining industry in the Grand Lake area was gaining in importance with each passing year.

As the industry grew, the coal resources of the province began to receive more attention. In 1872, the Provincial Government purchased a "diamond-boring machine" to make a survey of the Grand Lake area and thus obtain more detailed knowledge concerning the extent of coal reserves.

By 1887, the coal industry had gained sufficient importance for production figures to be included in the yearly statistical reports of the Federal Government. The accompanying graph illustrates coal output for the province from 1887 to 1958. In the former year, output was 10,040 tons; in the latter year, 787,949 tons. The peak year was 1959 with output estimated at over one million tons.

In 1892, the New Brunswick Coal Company was organized with the assistance of the Provincial Government for the purpose of working the mines more

systematically and on a larger scale than previously. This project did not meet with immediate success and coal output continued to range between six and ten thousand tons for the next few years. During the nineties, steam hoists were first introduced, and to a large extent replaced the horses which had been used up to that time.

In 1895, coal was still being mined primarily by the farmers who had it located in their lands and the Grand Lake mining area was still a very localized operation. The coal was hauled from the fields by means of horses to points on Grand Lake where it could be transferred to small schooners. These schooners, with a capacity of thirty to sixty tons, then carried the coal to Saint John or Fredericton. In the winter, the coal was hauled by teams to Fredericton.

In 1899, production exceeded 10,000 tons for the first time since 1887, expanded to 18,795 tons in 1902, and then dropped to 9,112 tons in 1904. The increased activity around the turn of the century was due largely to the Grand Lake area becoming more accessible through the construction of railroads. In 1890, a railway was built from Norton to Chipman, and, in 1904, the line was extended from Chipman to Minto.

The completion of the railway from Norton to Minto, and its subsequent extension to Fredericton in 1912, inaugurated a new era for the coal industry of the province. Coal output rose to 29,400 tons in 1905 and continued to rise - with only a momentary setback in 1912 - until the years immediately after World War I.

In 1905, a clam-shell was first used for stripping, followed by steam shovels and draglines in 1914. The New Brunswick Coal and Railway Company was incorporated in 1905, "To more rapidly develop the coal areas of Queens and Sunb

Counties," but this company failed to survive. In 1908, the company's lease of 65 square miles, embracing all the Crown lands in the Grand Lake basin, was cancelled, after an investigation proved the company's non-compliance with the terms of the lease. Other developments, however, were not deterred. By 1907, there were at least twenty-one companies or individual operators engaged in mining at Minto and the immediate vicinity.

Meanwhile, the coal industry was being more closely regulated by provincial statutes. The original mining act in New Brunswick was passed in 1855, but had little application to the coal industry. In 1872, regulations were brought down regarding New Brunswick minerals and royalties of twenty cents a long ton were imposed on coal moved by land. Royalties on coal shipped by water were not applied until 1915. In 1890, the mining laws were revised and the General Mining Act came into effect, but it was not until 1910 that coal was placed under the same regulations as other minerals. In that year, by Order-in-Council, owners of coal lands gained the privileges of obtaining licenses or leases at the rate of $5.00 per 100 acres under the General Mining Act.

<u>World War I to World War II:</u>

The outbreak of World War I provided additional impetus to the growing coal industry, although production was limited by the scarcity of labour in the war economy. At this time, two general methods of mining were in use:- shaft mining through the room and pillar system and, where there was a light overburden, stripping by steam shovel. Most of the shaft mining was carried on at depths of thirty to forty feet. The method of shaft mining was still practically all by hand with machinery used only for hoisting. No cutting machinery had, as yet, been introduced, "possibly partly on account of

initial cost, which means a good deal to small operators and partly because any machine which would waste a portion of the thin seam found in this district would not be looked upon with favour."[1]

Increased demand for coal also meant that stripping operations were conducted more extensively. The first large operation of this type in New Brunswick, and probably in Canada, was carried out by Baird and Howie under contract on the Rothwell Coal Company's ground about three-quarters of a mile south of Minto. This operation was apparently started in 1914. By 1918, the stripping method was being used entirely by the Sheffield Company and in some areas by the Rothwell Coal Company, the Minto Coal Company, and Harvey Welton. Considering the rapid growth of this method of mining since the end of World War II, it is interesting to note the forecast of the 1917 Annual Report of the Department of Lands and Mines:-

> While the stripping method is very interesting and no doubt valuable, it can never more than partly replace the tunnel method because there is a point where the quantity of overburden makes stripping impracticable..... Quite probably thirty feet or thereabouts will be the maximum.

This particular Report also includes an extensive survey of the mining conditions of this period, providing some interesting background to the coal industry during the First World War:-

> A good miner can readily make Five Dollars ($5.00) per day. All the mining operations provide small houses for their workmen, but the surroundings are usually very unattractive. Most of the mining at Minto is underground work, the usual scheme of this work being one or more vertical shafts, large enough to take freely the full box and the empty one, a main level about five feet high following the surface of the coal seam from the base of the shaft and bye-levels about thirty feet apart at right angles to the main levels.

[1]New Brunswick Department of Lands and Mines, Annual Report, 1918.

The individual miner with sometimes a helper on his own bye-level filling his little car with coal and pushing it back to the main level and then to the foot of the shaft to be hoisted above, weighed or tallied by the box and run out to the coal dump or chute to the car. Any wall rock or clay which he cannot stow in the vacancy left by the coal he also sends up and this is switched off to the waste dump, which is always seen at every shaft house. For this waste he is paid nothing.

The miner must do his own timbering with timbers supplied him and he pays for his own explosives. Monobel, a low power nitro glycerine explosive is used altogether, although the engineer for the Grand Lake Company reports good satisfaction in the use of black powder, claiming that the coal is not so badly shattered with it as with the use of dynamite.

Peak production for World War I was reached in 1918 with an output of 268,212 tons. In the months before the end of the war, every effort was being made to increase coal production in preparation for another winter of war, and the movement of troops and materials. During the summer of 1918, factories and railroads were building up reserves of fuel and keeping demand at high levels. This situation suddenly changed with the cessation of hostilities in 1918 and the outbreak of an influenza epidemic during the winter of 1918-19.

It was not until late in the summer of 1919 that conditions regained a semblance of normality. Production, however, was far below that of the preceding year. In 1920, output recovered somewhat but was curtailed by a series of labour disputes. By 1922, the situation had improved remarkably and production totaled 287,513 tons, a figure which was not surpassed until more than a decade later in 1933.

A new departure in mining methods occurred in 1919 with the installation of a Sullivan Coal Cutter by the Ridge Coal Company, a new and relatively small operation which had made its first shipments in April, 1918. The following year, the Minto Coal Company introduced into its operations two coal cutting machines

of the bar type made by Mavor and Coulson of Glasgow, Scotland. These movements towards mechanization were followed by shaker screens, picking tables and crushers which had some effect in improving the quality of coal produced.

The year 1920 saw the establishment of the Federal Royal Commission to Deal with Disputes in Connection with Coal Mining Operations in Nova Scotia and New Brunswick. The Commission made some specific recommendations regarding the Minto district and it is interesting to review these in the light of the description of mine conditions three years earlier in the Department of Lands and Mines Report:-

> One dollar per day increase on all present rates, and 27 per cent increase on all contract rates....
> Better ventilation of the mines....
> All pushing of boxes to be paid for
> Better housing conditions; and adequate water supply for workmen.

In the peak production year of 1922, most of the coal (72.9%) was being supplied to users within the province for use in manufacturing or by the railroads. At the same time, a significant amount of coal was being shipped outside the province, with the province of Quebec receiving 14.9 per cent of total output, Maine 8.7 per cent, and Ontario 3.5 per cent. It is interesting to note that the Minto Coal Company was supplying all the fuel required by the buildings of the Federal Government in Ottawa.

Workings in the areas to the south of the line of the Fredericton and Grand Lake Railway were beginning to run out; and the Minto Coal Company, followed later by several of the other larger operators, began to make preparations to move to new areas north of Minto Station. This move was responsible for the slight decline in production which occurred in 1923. The output of the industry, nevertheless, was now valued at over one million dollars. A spur line connecting

Minto with the Hardwood Ridge Station on the C.N.R. was also completed in 1923, thus extending coal shipments into northern New Brunswick and facilitating sales of coal to the railways.

The next year output was reduced by nearly twenty-five per cent. The reasons were two-fold:- less coal was being demanded by the industries of the province, which were faced with economic difficulties at the time; and the radius of coal shipments was shortened by intensified competition from American and Nova Scotia coal and by increasingly discriminatory freight rates. The year 1925 brought a further reduction in output and another decline was registered in 1926.

At least a part of the decrease in output in the latter years can be explained by the occurrence of labour disputes. A Commission appointed by the provincial government investigated the situation, and a settlement of the difficulties was reached in the early spring.

From 1927 to 1929, the New Brunswick coal mining industry, under the influence of the general increase in economic activity, gradually increased production. Of all coal shipped, 67 per cent was being absorbed by the Canadian National and the Canadian Pacific Railways. The rest was either sold to local manufacturing plants or exported in small quantities.

The situation was, however, to change drastically with the onset of the Great Depression of the 1930's. By 1931, production had fallen to 182,181 tons. To assist the industry, the provincial government, through its agency the New Brunswick Electric Power Commission, decided to erect a thermal power plant at Newcastle Wharf on Grand Lake. The demand for coal for this plant helped to improve the condition of the industry somewhat in 1932.

A number of serious mining accidents occurring in the Minto district

in 1932 emphasized the need for detailed statuatory safety regulations. In 1933, a code of Mines Safety regulations was drafted and eventually became law. These regulations provided:-

An eight hour day for underground labour
No female labour whatever and no underground labour for a male under 16
Proper qualifications for miners and machine men
All shaft openings to be safeguarded
Periodic inspection of mines and equipment, all of which must be maintained in safe condition
Due care in the use of explosives
A signal code for hoists
Proper ventilation
Escapement shafts.

Penalties were fixed for the infraction of these laws and the Annual Report for 1933 of the Department of Lands and Mines concludes:- "The law has been in effect now for nearly a year and appears to be well observed." In January, 1934, however, a strike occurred because the working hours fixed by the Act of the previous year were not being observed. As a result of this incident, a local mines inspector was appointed to ensure compliance with the law.

Between 1932 and 1938, production was maintained at fairly constant levels ranging between 310,000 and 360,000 tons. In these years, the general level of profit was very low and most operations were marginal or, indeed, submarginal. A significant part of the problem was the increasing difficulties with the freight rate structure.

In the 1927 Report of the Royal Commission on Maritime Claims -- the so-called Duncan Commission -- recognition was given to representations for development of a wider market in Central Canada for the coal output of the Maritime Provinces. The following year, transportation subventions for the movement of coal to Central Canada were implemented, but, in fact, they did not have much effect until the nineteen-thirties. The 1928 legislation provided

assistance for the movement of Maritime coal by water to Montreal and then shipped by rail to points in the provinces of Quebec and Ontario.

By 1937, subventions totaling $1,800,000 had permitted the Nova Scotia industry to expand its output by almost 2,000,000 tons. The subvention policy thus played a major role in opening up new markets for Nova Scotia coal.

The effects of subventions in New Brunswick were not so beneficial. Located inland, the New Brunswick industry could not gain the same advantages as did the Nova Scotia industry. As a result of increased production, a reduction in overhead costs, and discriminatory rates which provided their coal with low per ton mile freight rates, Nova Scotia producers were also able to capture a substantial portion of the New Brunswick market itself.

In its submission to the Royal Commission on Dominion-Provincial Relations in 1938, the New Brunswick Government concluded its exposition of the situation of the provincial coal mining industry as follows:-

> We believe that your Commission could make recommendations that, if put into effect, would place the industry on a stable basis whereby wages could be increased and conditions made better for all those employed in the industry. If something is not done along this line, the industry may be able to struggle along but will not be in a position to do anything of a permanent nature to improve the conditions of those engaged in it.

<u>World War II to the Present</u>:

World War II broke out in late 1939 and, in a relatively short period of time, the Canadian economy adapted itself to war production. Wartime conditions, however, did not permanently increase the demand for New Brunswick coal. There were significant increases in production between 1939 and 1941 but output soon fell again and did not return to these levels until 1948 and 1949.

There were many reasons for the decline in production. The war brought about a movement of labour from the New Brunswick coal industry, particularly from shaft operations, to the armed forces and to industries engaged directly in war production. In addition to the difficulty of obtaining labour, New Brunswick mine operators were hard pressed by wartime controls. Coal prices were frozen but wages and other costs continued to rise. Operators also continued to face discriminatory freight rates and increasing competition in local markets from Nova Scotia coal. As a result of this situation, the later years of the war saw the level of output of the industry little changed from the nineteen-thirties.

The most important development of the war years was the great increase in output from stripping operations. This, of course, was due to the limited labour supply and the rising costs of shaft operations. As late as 1935, stripping operations had accounted for only 4.6 per cent of the output of the Minto field; but by 1940, this had risen to 16.4 per cent. At the conclusion of hostilities in 1945, approximately 44 per cent of New Brunswick coal output was being produced by the stripping method. This trend continued in the post-war period.

The years since 1945, in general, have witnessed a sharply rising level of production in the New Brunswick coal industry. There was a temporary decline in output in 1947, but the following year production approached the previous peak level of 1940-1941. The years 1950, 1951 and 1952 set successive production records for the provincial industry. The impetus for the rising demand came primarily from the load growth of the New Brunswick Electric Power Commission and the needs of the New Brunswick pulp and paper industry which was expanding production at a rapidly increasing rate.

There was a slight decline in coal production in 1953 when the Tobique Narrows Hydro plant came into operation, which reduced the coal consumption of the New Brunswick Electric Power Commission. Although consumption by the power commission decreased again in 1954, reflecting a full year's operation of the Tobique plant as well as above average hydro generation due to heavy rain-fall, generally improved economic conditions lead to an expansion of output to 781,271 tons. In 1956, output increased by over 200,000 tons, and production levels remained high in 1957, despite a decline in business activity late in the year. The reduced output for 1958 (787,949 tons) was due to the lower level of business activity and the large hydro output obtained from the new Beechwood plant in one of the highest water years on record.

As has been previously noted, the rapid shift to stripping operations, which began in the war years, has continued throughout the whole post-war period. Attempts were made to mechanize underground operations, but these were largely abortive due to the lack of special equipment suited to the thin seam and problems involved in moving the coal away from the working face. Larger and more efficient stripping machines were brought into operation, replacing older machines which were small and capable only of operating to a depth of thirty feet. As a result, average annual output per unit of labour increased from 455 tons in 1946 to a peak of 974 tons in 1955. This increase in productivity reduced costs while assisting in a rise in average wages and salaries paid to miners from $1,726 in 1946 to $3,140 in 1957, an increase of over 80 per cent.

The following table shows production and employment by the two methods of mining, shaft and strip, for selected years in the post-war period:-

TABLE I

Year	Shaft Mining		Strip Mining	
	Average Employment*	Percentage Output of Total Production	Average Employment	Percentage Output of Total Production
1945	763	56.1	230	43.9
1947	526	51.7	334	48.3
1949	535	41.8	372	58.2
1951	517	29.4	432	70.6
1953	425	17.2	497	72.8
1955	501	18.0	496	82.0
1956	505	18.5	515	81.5
1957	505	18.5	515	81.5
1958	394	17.2	465	82.8 (est.)
1959	460	18.6	572	81.4 (est.)

The very considerable increase in New Brunswick coal production, in the period since World War II, can be traced largely to the increasing use of lower-cost methods of strip mining. In Canada as a whole, coal output declined about 6.3 per cent in the period 1947 to 1956. In Nova Scotia, production increased by about 29 per cent in the same period, but output in this other Maritime Province - the major competitor of New Brunswick - reached its peak in 1950 and since that time has declined.

The coal industry of New Brunswick, during these years, registered an increase of 65 per cent in total output. This figure is somewhat inflated because of the low output in 1947; but even eliminating this factor New Brunswick output - from 1948, when production again reached the proportions of the early forties, to 1956 which was the peak production year to date - increased by approximately 45 per cent. The growth of New Brunswick production, as contrasted with that of the Nova Scotia industry and the Canadian industry as a whole, is illustrated

* based on data supplied by the New Brunswick Coal Producers Association.

by the following table:-

TABLE II

Year	New Brunswick	Nova Scotia	Canada
1947	345,194	4,118,196	15,868,866
1948	[illegible]22,136	6,430,991	18,449,689
1949	540,806	6,181,779	19,120,043
1950	607,116	6,478,405	19,139,112
1951	653,439	6,307,629	18,586,823
1952	742,8[illegible]	5,905,265	17,579,002
1953	721,252	5,7[illegible]7,026	15,900,673
1954	781,271	5,842,896	14,913,579
1955	877,838	5,731,026	14,818,880
1956	983,482	[illegible]	14,915,033
1957	976,597	5,685,770	13,189,155
1958	787,949	5,269,879	11,687,110

Since the end of World War II, the Maritime coal industry has received increasing assistance from the Federal Government. The New Brunswick industry benefited, to a degree, from this assistance but, as will be noted elsewhere in this Report, to a much lesser extent than the Nova Scotia industry.

Although the structure of coal subventions was amended in 1949 to bring it into line with post-war conditions, the financial assistance in the post-war period for New Brunswick coal moving to Quebec and Ontario produced little effect prior 1952. The increasing production of coal from 1948 to 1952 found its markets within the province and across the border in Maine, and shipments to Quebec continued to be extremely small. The coal moved to Ontario was negligible. With the introduction of the 45 per cent rate of assistance in 1952, coal exports to Quebec rose to 31,390 tons in the fiscal year 1953-54 (compared with 2,781 tons in the preceding fiscal year), and Quebec has continued to be a major consumer of New Brunswick coal exported outside the province. In the fiscal year 1957-58, a total of 73,095 tons were moved to that province under subvention.

Another type of assistance from the Federal-Government came in the form of the Maritime Coal Production Assistance Act, 1949. According to section three of this Act:-

> (1) ... The Minister ... may, in accordance with an agreement between the Minister and a coal producer, make a loan to the coal producer for the purpose of carrying out a project, but no loan shall exceed two-thirds of the cost, as determined by the Minister, of the project in respect of which it is made.
> (2) No agreement shall be entered into under this Act unless the Minister is satisfied:
> (a) that the project is in the public interest and completely and efficiently planned in its economic, engineering and operating aspects;
> (b) that the project when completed will substantially increase the efficiency of coal production;
> (c) that the coal producer is able to finance the cost of the project in excess of the amount of the loan provided by the agreement, and will efficiently operate the plant after completion of the project; and
> (d) that the coal producer is following sound and reasonable policies as to dividends and will repay the loan and interest as provided by the agreement.

The Act is administered by the Dominion Coal Board. Up to 1958, three loans were made to the Avon Coal Company for mechanization of their operations and for the construction of a washing plant, two loans were made to D.W. and R.A. Mills, Limited, for the purchase of a walking drag line and for the construction of a washing and drying plant, and a small loan went to Victor McMann towards the development of a new shaft mine.

On January 31, 1958, Parliament passed the Atlantic Provinces Power Development Act. This Act provides that the Minister of Northern Affairs and National Resources may, on behalf of the Federal Government, make agreements with any of the four Atlantic Provinces for co-operation and financial assistance from Ottawa for the construction of thermal power plants and transmission lines.

The Act also authorizes the payment of a subvention of 7.43 cents per million BTU on Maritime coal used in thermal electric power production. These payments are administered by the Dominion Coal Board and are intended to reduce power costs and expand the market for coal in the Atlantic Provinces.

(2) Coal in the New Brunswick Economy

At the present time, coal production in New Brunswick has a gross value greater than that of any other mineral. In 1958, the gross value of all minerals produced in the province was $17,053,898. Coal represented 35.8 per cent of this total or $6,633,503. The next two ranking minerals were cement, and sand and gravel, which were 16.3 per cent and 12.7 per cent, respectively, of the 1958 total.

In 1959, coal production has been well above 1958 levels and the output for the year is estimated at 1,000,000 tons with a value of $8,400,000. This is a record output for the New Brunswick industry.

The Dominion Bureau of Statistics does not publish any annual estimates of the size and distribution of the New Brunswick labour force. Rough estimates, prepared by economists at the University of New Brunswick, indicate that, in 1959, the provincial labour force was distributed as follows:-

TABLE III

Sectors	Employees
Minerals	2,200 (coal 1,000)
Lumber and other wood-using industries	8,000
Pulp and Paper	10,000
Fishing and fish processing	12,500
Agriculture	22,000
Other Manufacturing	11,500
Construction	20,000
Sub-total	86,200
Services	81,000
Unemployed	12,800
	180,000

The figures given for the pulp and paper industry and the lumber and other wood-using industries include estimates of the labour force employed in

logging operations. While the above figures are not considered to possess a high degree of accuracy, it is thought that they do give some idea of the relative totals of employment in the various sectors of the provincial economy.

While the labour force employed in the New Brunswick coal mining industry is only a small percentage of the total labour force of the province, it is of real significance to the economy of Central New Brunswick. Indeed, it is the sole support of the village of Minto and the connecting villages of New Zion, New England, Slope Road, New Avon, and North Minto. In addition, a proportion of the population of Chipman is employed in the coal mining industry.

The Commission made an effort to determine the total number of people directly and indirectly dependent on the coal mining industry of the province. This study indicated that each job in the coal mining industry created approximately one other job elsewhere in the provincial enonomy. Thus, the total of direct and indirect employment based on the coal mining industry is estimated at 2,000. In New Brunswick, the labour force is approximately one-third of the population, so that the total number of people dependent on the provincial coal mining industry is in the vicinity of 6,000.

<u>Summary</u>:

Although the New Brunswick coal mining industry supports only a relatively small proportion of the total population of the province, it is by far the most important employer of labour in the Minto-Chipman area. Thus, a sharp decline in employment in the industry would create a most serious social and economic problem.

Recommendation:

The economy of the Minto-Chipman area is too dependent on one industry. New industries need to be brought into the area and local organizations should work with the provincial Department of Industry and Development towards this end. A pulp mill, located on Grand Lake, would by itself provide the area with the industrial diversification that is so badly needed.

In recent years in both Great Britain and the United States the problems of retarded areas where there are high levels of unemployment and great dependence on one or a few industries has attracted considerable attention. In the United States the Area Redevelopment Bill is before Congress and may well pass the present session. This provides for low interest rate loans and grants to assist public authorities and private business in depressed areas. In Great Britain, Parliament has passed recently the Local Employment Act which consolidates existing legislation and provides a series of incentives for new films to move into retarded areas. These incentives include the construction of factories and their lease to private business at low rentals, capital grants and low interest rate loans.

This problem is certainly as critical in Canada as it is in the United States and Great Britain, and thus the corresponding corrective measures would be of great assistance to the whole Maritime Coal Industry. This Commission therefore believes that there is need for similar legislation in Canada.

CHAPTER II NEW BRUNSWICK COAL AND COAL RESERVES

(1) The Characteristics of the Coal

Minto coal is the same rank as coal from the mining areas of Nova Scotia. According to the American Society for Testing Materials classification, the rank of the coal is High Volatile A Bituminous. The classification of coals according to rank identifies the degree of their maturity and classifies coals according to their fixed carbon and calorific values calculated to the mineral-matter free basis; the higher rank coals being classified by fixed carbon on a dry basis, whereas the lower rank coals are classified by the calorific value on the moist basis. The coal generally is well handled, with anthraxylon layers predominating. It is highly fractured and readily disintegrates during mining, preparation and transport. Pyrite is present in appreciable quantities.

The average analysis of the coal is as follows:-

	Hard Coal	Weathered Coal
	Per cent	Per cent
Moisture	3.2	10.5
Volatile Matter	29.7	29.6
Fixed Carbon	47.8	53.4
Ash	19.3	6.8
Sulphur	7.6	2.6
Hydrogen	4.1	4.4
Carbon	62.7	68.4
Nitrogen	0.8	0.9
Oxygen	2.3	6.4
Calorific Value, B.T.U./lbs.	11,610	12,075
Ash Softening temperature	2,030°F.	2,280°F.

(2) Coal Reserves

Coal in New Brunswick occurs in rocks of Carboniferous age. These rocks form a roughly triangular area with the apex near Oromocto Lake. Approximately one third of the province is underlain by Carboniferous rocks.

Grand Lake Coal District - Previous Estimates:

The Grand Lake coal basin comprises approximately 100 square miles fringing the northern shores of Grand Lake. The towns of Chipman and Minto are the two main centers of the industry with the latter being the more important.

Coal reserves have been calculated for the district from information supplied by the coal operators and from maps prepared by the New Brunswick Mines Branch.

Dr. Abraham Gesner, Provincial Geologist for the province of New Brunswick, gave the first published estimates of New Brunswick coal reserves over 100 years ago. In his Fourth Annual Report (p. 64) he states - "The Province has been estimated to contain twenty-six thousand square miles: when it is considered that one third part of this vast tract of country contains more or less of bituminous mineral, the quantity of coal in New Brunswick will appear inexhaustible." Gesner's enormous reserves were based, not only on a very wide lateral extension of the Minto seam, but on the assumed presence of deeper seams. Subsequent investigations have failed to confirm either of these views.

A more realistic statement of reserves was published in the Geological Survey of Canada's Report of Progress for 1872-1873. In this report Bailey and Matthew calculated that approximately 155,000,000 tons of coal underlay the Minto-Chipman district. In the calculations an average coal thickness of twenty inches was assumed to underlie 53,760 acres. It was further assumed that the specific gravity of the coal was 1.27.

Bailey and Matthew were not, however, without some of Dr. Gesner's optimism. They speculated that the Minto seam probably extended beyond the Grand

Lake district giving in addition to the 155,000,000 tons, reserves which would total not less than about 3,500,000,000 tons.

The next detailed estimate of reserves was made by W. S. Dyer in 1926. Dyer divided the coal basin into areas and assumed an average thickness (which varied from area to area) of from 16 to 30 inches. He used a specific gravity figure of 1.3 in his calculations and assumed that 95 per cent of the coal was recovered in mining. His statement of reserves is as follows:

	Acres	Short tons
Actual coal	2,750	8,200,000
Probable coal	25,600	61,000,000
Possible coal	67,200	166,000,000
	95,550	235,200,000

In 1945 both The New Brunswick Coal Producers' Association and the Department of Lands and Mines submitted statements of reserves to the Royal Commission on Coal. The former group estimated the actual reserves as being 25,000,000 tons while the Mines Branch gave the following estimates:-

	Acres	Short tons
Probable coal	33;282	69,474,900
Possible coal	4,393	8,809,400
	37,675	78,284,300

Mines Branch personnel used a method similar to that employed by Dyer in their calculations. The difference in results can be ascribed to more detailed information available to the Mines Branch.

B. R. MacKay in 1947 employed a similar method in calculating the coal reserves of the Grand Lake coal basin. However, he obtained different estimates because he assumed greater tonnage yields per acre and a recovery rate of only 50%.

His estimates are as follows:-

	Acres	Short tons
Mineable		
Probable coal	33,282	89,814,000
Possible coal	4,393	11,566,000
Total coal	37,675	101,380,000
Recoverable		
Probable coal	16,641	44,907;000
Possible coal	2,196	5,783,000
Total coal	18,837	50,690,000

In 1951, J. E. Muller using a specific gravity of coal of 1.27 and an average thickness of 18 inches over 18,000 acres derived the following figures:-

	Short tons	
	Mineable	Recoverable
Coal at less than 50 feet depth	44,000,000	22,000,000
Coal at 50 to 100 feet depth	47,000,000	23,000,000
	91,000,000	45,000,000

Muller states, (p. 38) "The area of coal between 50 and 100 feet depth cannot be outlined and measured as readily as that between 0 feet and 50 feet." Thus, his reserves were broken down on a depth basis. Muller used an extremely low recovery rate (50 per cent) and furthermore, excluded reserves lying at depths greater than 100 feet stating that that was then the maximum depth to which coal was mined.

The Department of Lands and Mines prepared a special estimate of coal reserves for this Commission from detailed information obtained from the coal operators in conjunction with surveys undertaken by the Mines Branch. The coal producers were most co-operative in making available to the Commission all the data resulting from their most recent drilling and exploration programs.

Coal Reserves of New Brunswick - Royal Commission Estimates:

Four classifications of coal have been used. The first three are calculated reserves and the fourth is merely an estimate of possible additional reserves that the field may contain. The classifications are as follows:-

Measured Coal - Coal for which tonnage is computed from dimensions revealed in outcrop and drill holes. The sites for inspection and measurements are so closely spaced, and the geologic character is defined as well, that the thickness is well established. The computed tonnage is judged to be accurate within 5%.

Indicated Coal - Coal for which tonnage is computed from specific measurements and partly from projection for a reasonable distance on geologic evidence. The sites available for inspection and measurement are too widely or otherwise inappropriately spaced to outline the coal completely or to establish its thickness throughout.

Inferred Coal - Coal for which quantitative estimates are based largely on a broad knowledge of the geologic character of the coal horizon and for which there are few, if any, drill hole measurements. The estimates are based on an assumed continuity for which there is geologic evidence.

Possible Coal - Coal for which tonnage is computed from an assumed thickness of the seam; and an area, which from geologic evidence has an indication that coal may be present in mineable quantities.

Calculations have been made by using a factor of 145 short tons per inch per acre. This figure represents an average weight of the coal and is derived from a specific gravity of coal of 1.28 or 80 pounds per cubic foot.

Isopach maps were drawn for all areas of which sufficient information was available. For those portions which have been insufficiently drilled to be classified as measured coal, weighted averages of the thicknesses were obtained. Isopach maps are prepared by joining all points of equal thickness of the coal seam by contour lines. The resultant map represents the subsurface distribution and thickness of the coal horizon. Areas were determined by the planimetric method.

Additional possible reserves for those areas which may be underlain by coal, and no data is available, have been estimated at 20,000,000 tons. This figure has been determined by assuming an average thickness of 14 inches of coal or 2,000 short tons per acre.

In addition to the classification of reserves, a further division based on the depth of overburden has been made. A depth of 80 feet has been taken as the lower limit of strip mining with existing equipment. This figure does not take into account variations in the overlying rock types, new and heavier equipment, or other than standard mining methods now employed.

Recoverable coal is estimated at 95 per cent of mineable coal.

In strip mining, field practice indicates a recovery rate of between 95 and 100 per cent. Thus, when the shaft-strip production rates and the respective recovery rates are considered, the assumption of an overall recovery rate of 95 per cent is reasonable.

(a) Grand Lake Coal Basin

TABLE IV

Coal Reserves	Mineable	Recoverable
Calculated reserves (short tons)*	43,730,000	41,640,000
Possible reserves (short tons)	20,000,000	20,000,000
	63,730,000	61,640,000

Total Acreage ....17,150 acres.

*Calculated Coal Reserves (short tons)

Measured	Indicated	Inferred
20,530,000	15,040,000	8,157,000

Total Reserves 43,730,000

TABLE V

Comparison of Shaft and Strip Mining Reserves (short tons)

Shaft Reserves (greater than 80 feet)

Area	Measured	Indicated	Inferred
Eighteen Brook	262,900	-	287,700
Little River	-	320,500	451,500
Minto Area	493,300	3,697,000	-
Midlands, Iron Bound Cove	4,661,000	5,267,000	2,985,000
Coal Creek	-	-	215,800
	5,417,200	9,284,500	3,940,000

Total Shaft Reserves 18,640,000

Strip Reserves

Area	Measured	Indicated	Inferred
Eighteen Brook	2,697,000	62,640	-
Little River	3,041,000	555,900	1,574,000
Minto Area	2,088,000	517,800	-
Midlands, Iron Bound Cove	4,932,000	1,551,000	556,200
Coal Creek	2,356,000	3,073,000	2,088,000
	15,114,000	5,760,340	4,218,200

Total Strip Reserves 25,092,540

(b) Beersville Coal Basin

The Beersville coal basin is located in Kent County, and has been the centre of a small coal mining industry for many years. The coal outcrops along a gentle, westerly trending anticline which parallels the Coal Branch River. Geological evidence indicates that coal may underlie an area extending from Hebert village to the Bass River. However, lack of subsurface information

precludes reserve estimates in areas other than the immediate vicinities of Beersville and Coal Branch. Even in these latter districts, drilling has been limited and drill holes tend to be distributed in scattered clusters.

Reserves have been calculated in a manner similar to the Minto-Chipman reserves, and are given as follows:-

Calculated Reserves (short tons)

Measured	Indicated & Inferred
1,000,000	3,000,000

Total reserves 4,000,000

(c) Dunsinane Area

Coal was mined in the Dunsinane area, Kings County, many years ago. Recently, interest has been revived in the area.

Four seams are known to be present and previous mining had been restricted to the lower two seams. The uppermost seam has been subject to recent exploration and has been found to be 22 inches thick and to dip eastward at 12° to 15° for an unknown distance. The underground method will have to be employed in any mining venture in this area due to plunging nature of the seam. Due to the paucity of information, reserves have been calculated as inferred shaft reserves, and are estimated to be in the order of 100,000 short tons.

Several other areas in the Central Basin may contain coal in economic quantity, but lack of information makes the estimation of reserves in these areas impossible. The Tracadie, Nashwaak, and Gagetown sub-basins are possible favorable areas in that they contain coal seams, which,at the outcrops, vary in thickness from a few inches to a foot. The distribution of the seams stratigraphically,

relationships of the outcrops to the depositional basins, and the extent and boundaries of the basins remains to be determined before these areas can be assessed. This would necessitate a detailed geological study followed by a drilling programme.

Summary:

The following is a statement of the total coal reserves of New Brunswick:-

Total Reserves (short tons)

Minto Chipman area	63,730,000
Beersville area	4,000,000
Dunsinane area	100,000
Total	67,830,000

Calculated recoverable coal reserves in the Grand Lake area are estimated at 42 million tons. This total can be broken down into roughly 24.5 million tons which can be recovered by strip mining and 17.5 million tons which can be recovered by shaft mining. The strip reserves are at depths of no greater than 80 feet, while the shaft reserves lie between 80 and 140 feet. Additional possible reserves are estimated at 20,000,000 tons.

Recommendations:

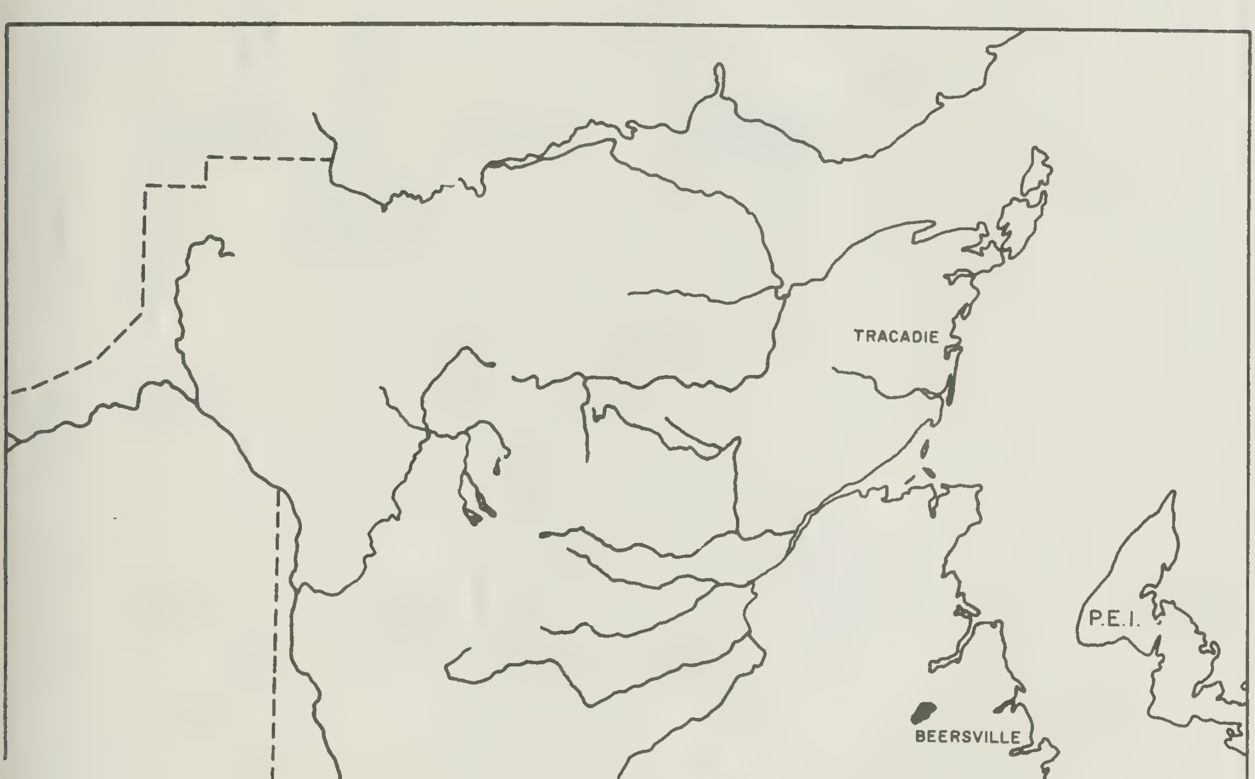
(1) On the basis of the Commission's studies and examinations, we believe that the output of the Grand Lake field should not fall below a minimum of 850,000 tons a year nor exceed a maximum of 1,100,000 tons a year. An output of less than 850,000 tons a year would result in a level of unemployment which would present serious problems for the area. An output appreciably above 1,100,000 tons a year would result in the calculated reserves being depleted at a rate which could present serious problems in the future. On these assumptions, proven reserves are adequate for from 40 to 50 years.

(2) As the remainder of this report will reveal, over the next decade, the New Brunswick coal industry will be faced with a number of complex problems. The solution of these problems will require the co-operation and collaboration of the provincial government, the coal producers, the miners, and Local 7409 of the United Mine Workers of America. Accordingly, the Commission recommends the establishment of a New Brunswick Coal Industry Advisory Board. The general task of this Board should be to seek solutions to problems confronting the industry before they became critical.

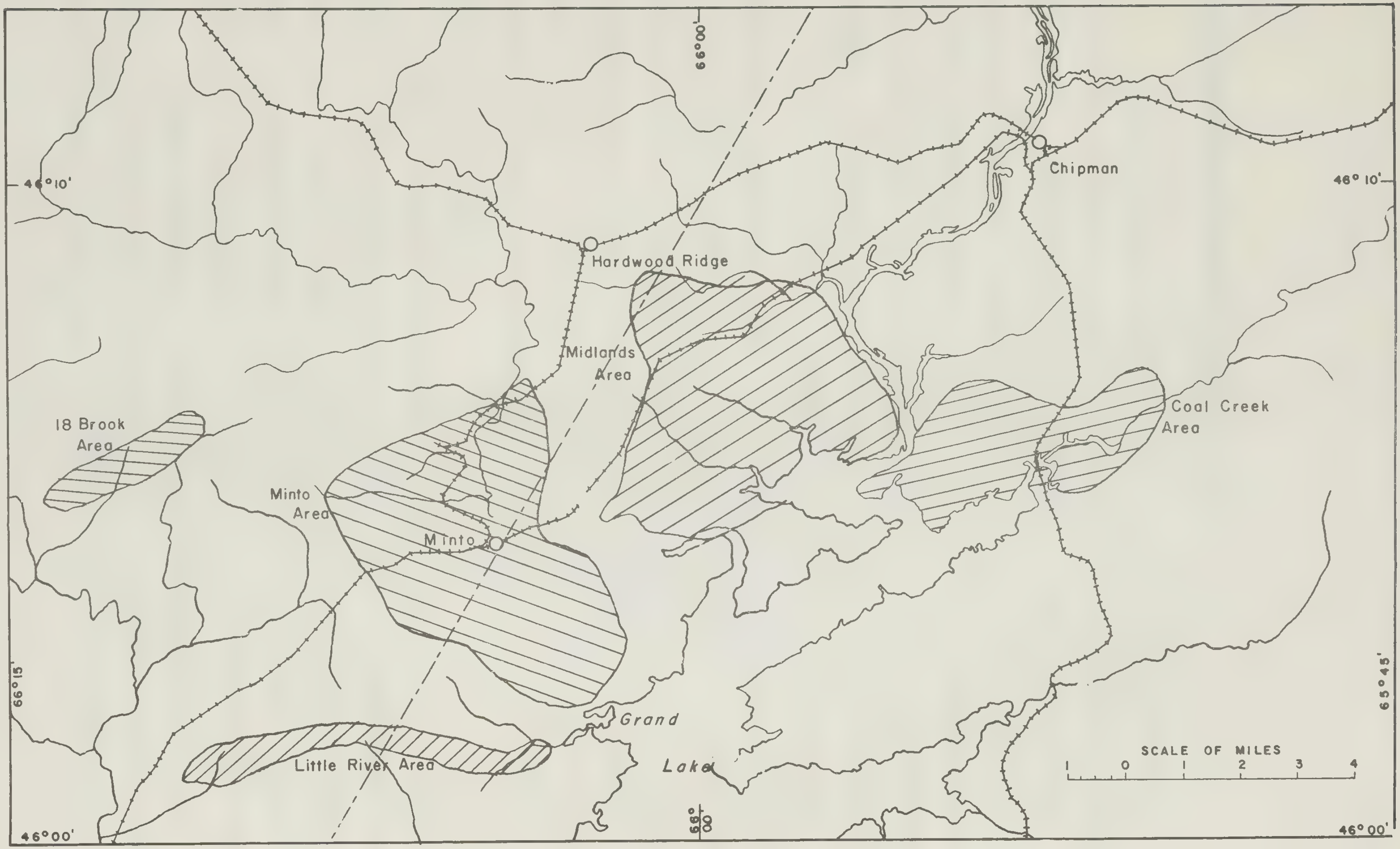
The Board should be composed of representatives of the provincial government, the New Brunswick Coal Producers Association, and Local 7409 of the United Mine Workers of America. The Commission foresees the Board performing the following functions:-

(i) The revision of the target minimum and maximum figures stated above in the light of changing circumstances relating to estimated reserves, mining methods, markets, and other factors.
(ii) The study and development of more efficient methods of mining.
(iii) The study of markets and future market trends.
(iv) The opening up of new markets for New Brunswick coal.
(v) Conferring with officials of the Dominion Coal Board and other officials of the federal government as to the means by which national policies may be made more suitable to the particular needs of the New Brunswick coal industry.
(vi) The survey of possible new non-fuel uses for coal.

LOCATION OF MAJOR COAL OCCURRENCES



DISTRIBUTION OF COAL RESERVES, MINTO - CHIPMAN AREA



(3) Coal Licensing and Leasing in New Brunswick.

Mining operations in New Brunswick are governed by the Mining Act, Chapter 146 of the Revised Statutes of New Brunswick. This Revised Act was passed in 1952 and was amended in 1953, 1954, 1955, 1956 and 1958. Under the Act, mines and minerals constitute a property independent of the soil covering them and, as such, mining rights are public property. As a consequence, no person can work or operate a mine without having obtained a license or lease from the government for this purpose. The present status of licenses and leases will be reviewed briefly.

A mining license is an authorization to work a mine. The holder of a mining claim may apply for a license when he has met the following conditions:- the claim has been recorded and is in full force and effect; the holder has worked his claim for twenty-five days of eight hours each; he has deposited with the Recorder a survey of the claim made by a New Brunswick Land Surveyor; he has posted a bond with the Department of Lands and Mines to recompense the owner for any damage to the soil; and he has paid the necessary fee of ten dollars for each claim of forty acres.

Such a license is valid for one year from the date of issue and may be renewed for further twelve-month periods at the regular fee upon the presentation of proof that twenty-five days of work have been done on each forty acres of holdings. In exceptional cases, the extension of a license may be made by the Minister of Lands and Mines where the required work has not been carried out.

A mining lease may be granted upon application to the holder of a mining license who has opened a mine and worked it for six months. The tract of land to be leased must have been surveyed and the prospective lessee must deposit

with his application the rental in advance for the first year's tenure. This amounts to ten dollars for each forty acres leased, and a bond must be posted to cover damage to the property. A release from claims for damage given by the owner of the land covering the mine is also acceptable. After the first year, the rental is paid annually on June 30th, but is reduced by the amount of the royalty paid over the twelve-month period. Thus, once the royalties exceed the rental, then the latter is no longer paid.

A mining lease is granted for a term of twenty years and can be renewed up to a maximum of eighty years from the date of recording. The lease may not be transferred or assigned to some other person without the permission of the Minister of Lands and Mines. It may be surrendered at any time by filing a notice in the office of the Recorder. Where work upon any mine or mining operation has been abandoned, not carried on for a space of six months, or not operated efficiently and continuously, notice may be given of an investigation of the situation.

If the results of the investigation warrant it, the lease can be cancelled and the mining rights forfeited or the time can be extended during which the lessee is required to commence effective operations on the leased premises. If the time is extended and the obligations still are not met, then the lease is cancelled. In the case of a corporation, however, in the interests of the minor shareholders, the Minister of Lands and Mines may recommend to a Judge of the Supreme Court the appointment of a trustee to direct the mining operations rather than to cancel the lease. The decision of the Minister's investigation may be appealed by the lessee, either to the Court of Appeal or to

a Judge of the Supreme Court. Failure to pay the rental or the royalty (fourteen cents per ton payable on the twentieth day of each month) automatically involves forfeiture of the lease.

An individual holding a mining lease is required to keep accurate plans of any mine and its works open to inspection by officials of the Department of Lands and Mines. Any mine which is abandoned must have all pits or openings closed and protected so as not to be a source of danger to the public. Failure to carry out this provision constitutes a violation of the Mining Act.

The holders of either a mining license or a mining lease are required to make periodic reports to the Department of Lands and Mines. The Mining Act provides that, on or before the twentieth day of each month, the owner, agent or manager of a mine must send to the Minister a return for the preceding calendar month indicating the amount of coal mined, the probable use and destination of the coal, the amount of royalty payable, the number of persons employed, the different classes of persons so employed, and any other information which may be specifically requested.

<u>Summary</u>:

A coal mine in New Brunswick may be operated under either a mining license or a mining lease. The mining license must be renewed each year while the lease is granted for a period of twenty years and can be renewed periodically. The Commission believes that this dual system has some advantages and thus should be retained. The chief advantage of the system is that a mining operation can be kept under license until such time as officials of the Department of Lands and Mines are satisfied that the operation is being conducted in compliance with the law, mines regulations, and the public interest.

Recommendations:

In dealing with the matter of licenses and leases, the Commission makes the following recommendations:-

(1) In the past, the statement has often been made that the general pattern of licenses and leases in the Minto area did not always lead to efficient mining operations. For example, the submission of the New Brunswick Department of Lands and Mines to the Royal Commission on the Coal Industry of Canada, in 1945 quoted Mr. E. Swartzman of the Federal Department of Mines and Technical Surveys as follows:-

"Independent mining by such a large number of operators with little or no reference to one another without co-operation in a field with such a thin seam as that available in Minto, and producing such a relatively small tonnage, has resulted in a random and, generally speaking, unplanned exploitation of the coal." The brief goes on to state that:- "The cessation of underground operations because the lease boundary had been reached has on a number of occasions interfered with the economic removal of blocks of coal."

In recent years, this situation has improved greatly due to the increased willingness of mine operators to co-operate and work together. The matter is one of the greatest importance, however, and, in the light of the intense competition that coal is facing from other fuels, is deserving of the most careful attention. Thus, the Commission recommends that the present situation as regards the pattern of licenses and leases be reviewed by the Department of Lands and Mines and that an attempt be made, in co-operation with the holders of mining rights, to develop a pattern which will be conducive to the highest possible level of coal recovery.

(2) The Commission gave careful consideration to the matter of the worked-out areas which are produced as a consequence of strip mining operations. To date, these areas constitute approximately 4,600 acres. The excavations, located in these areas, vary from the small holes produced by the limited operations during World War I to the great holes, over 60 feet deep and 100 feet wide, produced by the large machines which have been in operation in recent years. In addition, the spoil banks, which constitute by far the major portion of the worked-out areas, consist of mounds of earth and rock averaging 30 ft. in height and having an angle of slope of 40 degrees. These areas can present hazards to life and limb and generally represent forest land which has been probably permanently destroyed.

The Commission is satisfied that, in recent years, a great deal has been done to eliminate hazards. Upon the completion of operations, all operators are now required to reduce the final highwall to an angle of slope of 40 degrees. In some old workings, this has not, as yet, been done and the Commission recommends that the Department of Lands and Mines insist that it be done where a real hazard exists.

During stripping operations, the highwall is left unenclosed and this certainly creates a hazard. The Commission recommends that operators be required to enclose the highwall by a temporary fence where operations are being conducted close to residential areas, and that no-trespassing signs be erected.

The Commission requested the Department of Public Works to prepare estimates of the costs that would be involved if the excavations were required to be filled in and the spoil banks levelled. This study indicated clearly that the costs would be high and greatly in excess of the present value of the land

or any value that it conceivably could have in the future. The Department of Lands and Mines informed the Commission that practically all the land in question is below the provincial average as regards its capacity for forest growth.

Section 101 of the Mining Act requires operators to pay for damages that accrue as a consequence of mining operations. Thus, the Commission recommends that, before Crown Land is stripped, the operator be required to pay to the Crown the assessed value of the damages to the land. At the present time, this payment would be very small and could certainly have no significant effect on costs of production. It does recognize, however, an important principle: strip mining does result in the destruction of forest land. We have been assured by the Department of Lands and Mines that the matter of assessment of damages presents no administrative problems.

CHAPTER III MINING METHODS

(1) Strip Mining

With the coming of World War II and its great increased industrial demand for coal, a substantial increase in Canadian coal output became essential. At the same time, the shortage of manpower made it imperative that the increase in coal production should be procured on the basis of a higher productivity per man-hour. Mechanized strip mining provided the answer to this problem.

The experience of the war years has led to the accelerated development of strip mining in the post-war period. The reasons are twofold:- improvements in earth-moving machinery which have made it economically feasible to recover coal from open cut operations at increasingly greater depths, and the relatively higher productivity achieved in stripping as opposed to underground operations. The trend since World War II, in areas where strip mining is possible, is seen from the following table:-

TABLE VI

Strip Mined Output As A Percentage of Total Production

(selected years)

	1945	1952	1955	1958
New Brunswick	38	55	76	81
Saskatchewan	72	98	96	99
Alberta	17	38	47	50
British Columbia	*	15	18	12
Canada	15	31	37	36

* Not available.

New Brunswick Experience:

Early developments in strip mining in New Brunswick are reviewed in the historical section. This section will be concerned only with developments since World War II.

In 1946, The Royal Commission on Coal - the so-called Carroll Commission - summarized conditions in regard to stripping operations in New Brunswick as follows:-

> Typical units are small, both in respect to areas under operation and machinery used. Normally the latter consists of a steam-driven dragline with a 90 to 100 foot boom and a 3 cubic yard bucket. Practically all of these draglines date prior to 1932. Surface water presents serious difficulties. Most pits contain an abundance of water which interferes with the loading of coal and to a much greater extent with its transportation from the pits, which become quagmires in rainy weather. Some of the roads from the pits to the railroads are almost impassable during rainy weather, and the wet coal is largely unmarketable in winter months due to freezing. The ratio of cubic yards of overburden to one ton of coal recovered is 15.8.

The first major improvement over the situation described by the Carroll Commission came in 1947 when the Avon Coal Company installed a six-cubic yard electric-driven dragline. This machine made it possible to remove, economically, up to 50 feet of overburden, representing a strip ratio - the ratio of cubic yards of overburden per ton of coal - of approximately 30 cubic yards per ton.

In late 1949, the Avon Company also brought into operation a thirteen-cubic yard Marion electric-driven, walking dragline. This machine would remove, economically, up to 70 feet of overburden, at a strip ratio of about 40 cubic yards per ton. In 1950, the Miramichi Lumber Company installed the same type of dragline in their stripping operations.

During the early 1950's, A. W. Wasson Ltd., and D. W. and R. A. Mills Ltd. both installed Bucyrus electric-driven draglines. The size of the Wasson machine was seven cubic yards and the Mills machine, eleven cubic yards. In the past year, the Avon Company have brought into operation a fourteen-cubic yard Bucyrus machine. This has a strip ratio of about 41 cubic yards per ton and is, at the present time, the largest machine in operation in the field.

Since 1946, coal loading shovels have increased, typically, from 3/4 cubic yards to 1 1/2 cubic yards. Along with the dragline and shovel, the usual stripping operation in the Minto field includes one heavy bulldozer about the size of a Caterpiller D - 8 or an Allis-Chalmers 21; and a second bulldozer about two-thirds the size of the first; a rubber-tired, front-bucket type tractor; drilling machines which range in cost from $80,000 to $90,000 a unit; trucks for transporting coal; and, pumps for keeping the pits free of water. The maximum size pump used in the field is a six-inch diameter pump. A medium sized stripping operation involves expenditures for equipment approximating a half million dollars. A large operation might well run in excess of two million dollars.

At the end of 1959, where were 4 major strip operations in the Minto area and 7 small operations. These entailed the operation of 21 draglines - with capacities ranging from 3 cubic yards to 14 cubic yards. Approximately one-half the labour force employed in the industry, over 500 men, was engaged in stripping operations. Stripping produced 813,907 tons or 81.4% of the total output of the field. This represented an output of about 5.4 tons per man day as contrasted with 1.8 in shaft operations.

The Outlook for Stripping:

As has been indicated above, the trend in the Minto field as regards strip operations has definitely been towards larger machines removing increasing quantities of overburden per ton of coal. The average depth of operations has, of course, been increasing and, at the present time, approximates 50 feet. The maximum depth of operations is about 80 feet and the Commission considers this to be about the limit of profitable operations for the largest machines presently engaged in operations in the field.

In a brief presented to the Commission by D. W. and R. A. Mills Limited, the company stated that it was necessary for them to increase the depth of their stripping operations and they proposed the installation of a 34 cubic yard dragline on the basis of a loan under the Maritime Coal Production Assistance Act. The total cost of installing this machine was estimated at two million dollars.

The brief of the Mills Company stated that the 34 cubic yard machine would produce approximately 192,000 tons of coal a year and could profitably operate to depths ranging up to 120 feet. The brief also stated that:-

> The Company has made a proposal to the New Brunswick Electric Power Commission providing for the supply of coal at a substantially reduced price on a firm basis over a period of six years, which arrangement would involve a guarantee by the Commission of payment of a comparatively minor portion of the cost of the machine.

From this, the Commission infers that this large machine could entail substantial reductions in costs of production.

Production Costs - Shaft versus Strip Mining:

At the present time, in the Minto area, there are, of course, substantial differences in the costs of production of the various strip operations and the various shaft operations. In the case of the strip operations, differences in costs would reflect principally differences in the depth of overburden, differences in the composition of overburden and differences in the thickness of seam. As regards shaft operations, differences in costs are a reflection, primarily of mining conditions, thickness of seam, and labour productivity. Notwithstanding the diversity of the factors involved, the Commission believes the following generalization to be correct:- In recent years, average production costs of strip operations have been substantially below that of shaft operations. As a consequence, the level of profits on stripping have

been large when contrasted with shaft operations. Indeed, the Commission believes that the levels of profits on shaft operations has been below that normally obtainable in other sectors of the economy on the amount of capital invested.

Economic Implications:

The essential difference between strip mining and shaft mining in the Minto area, at the present time, is that strip production involves the employment of large amounts of capital and relatively small amounts of labour while shaft production entails the employment of large amounts of labour and relatively small amounts of capital. In the language of the economist and the businessman:- strip mining is capital intensive, while shaft mining is labour intensive. Given the economic circumstances of the New Brunswick economy and the Minto area, this difference is of real importance.

In recent years, the output per man employed in strip operations has been about 5 tons per day while the output per man engaged in shaft operations has ranged between 1.6 tons per day and 1.9 tons per day. Roughly, the labour content of shaft mined coal has been about three times that of strip mined coal. Thus, shaft mining provides more employment and results in a higher net income accruing to the provincial economy than does strip mining. Payments made to service the large amounts of capital employed in strip operations invariably move outside the province.

In a province and in an area, where incomes and employment are expanding rapidly and labour is in short supply, the above situation would not be of great significance. Labour which is displaced from one occupation readily finds employment in another. This is not the situation in New Brunswick and certainly not in the Minto area. As a consequence, it is most necessary to increase productivity in shaft operations so as to assist in maintaining the level of employment in Minto and Central New Brunswick generally.

In the years ahead if productivity per man in shaft operations does not increase, it is quite possible that all but a negligable amount of production would come from stripping operations. This would be achieved through very large drag-lines having a high output per man day. Thus, the total volume of employment would be drastically curtailed.

As a consequence, it is most necessary to increase productivity in shaft operations so as to assist in maintaining the level of employment in the Minto area.

(2) Underground Mining in the Minto Area

The two principle systems of underground mining are: room-and-pillar mining and longwall mining. Both systems are used in Canada and both have been used in mining the Minto field. Only the room-and-pillar system is in operation at the present time.

In either system the initial approach is by a vertical shaft, by drift or by slope. Although slopes have been used at various times in New Brunswick coal mines, the usual approach, and the only one now practised, is the vertical shaft. From the mine entrances, a system of roadways is developed, providing access to and from the coal. The roadways are referred to as the main tunnel levels and entries off the main tunnel as secondary tunnels. They are also used as air passages for ventilation. Ventilation is also provided in the Minto area by sinking an air shaft about 800 feet along the level from the main entry. Then cross-cuts are driven through the entries, parallel to, and about 140 feet from the level.

The distinguishing feature of the longwall system of mining is that the coal is extracted in a single operation as the working face advances in an unbroken line or wall. The roof is temporarily supported at the working face and then allowed to cave when the area is mined out.

The mining technique may be either longwall advancing or longwall retreating. In the first, the working face starts from the end of the coal block nearest to the mine entrance and advances inward. This method offers early coal production and a quick return on capital. In the second, which is generally preferred where conditions are suitable, narrow entries are driven through the coal to the far boundary and then the face is worked in retreat to

the main level. This method involves a greater initial expense but may reduce the cost of haulage in the long run. Ventilation is also improved. The mined out areas in the outer reaches of the workings may be completely caved since even the main entries are no longer required for access to the working face.

Longwall mining is widely used in the United Kingdom and to a lesser extent in Canada. Coal mines in the United States rely mainly upon the room-and-pillar method.

Attempts at longwall mining in the Minto area have proved unsuccessful to the present time. Prior to World War II, the Minto Coal Company, the Miramichi Lumber Company, and the Newcastle Coal Company operated shafts using the longwall method of underground mining. The Miramichi Lumber Company found that longwall operations incurred a small loss, as compared with the handpick method, due largely to more expensive timbering and inefficient face conveyors. The experience of the other two companies was somewhat similar.

When the Miramichi Lumber Company took over the Minto Coal Company in 1946, they continued to operate two longwalls along with handpick operations in the holdings of the absorbed company. There was apparently little difference between the costs of the two types of operation, probably because of the advantageous longwall mining conditions existing in the shafts in question. In 1948, the Miramichi Company began operating two walls retreating with face conveyors dumping into a centre, belt-type conveyor. Poor roof control and difficulties in operating the belt caused significant losses and the retreat longwall method was abandoned when the area was worked out in 1951.

The same year, the Miramichi Lumber Company opened a new slope with the intention of fully mechanizing the operation. Unfortunately, actual under-

ground conditions were not what preliminary drillings had indicated. Stresses from the roof were greater than originally anticipated and the contour of the coal seam proved extremely eccentric. This made it extremely difficult for the cutting machine to operate efficiently. In addition, the method of conveying the coal from the face proved unsatisfactory. After less than four years, the entire operation had to be abandoned at heavy loss to the company.

As a consequence of the above experience, Minto shaft coal producers have come to prefer the room-and-pillar method of underground mining. In the room-and-pillar technique, the coal to be worked is divided into blocks by driving entries at right angles to the main level. Each block is moved by cutting "rooms" off the entries, coal being left standing between the rooms and the level to support the strata immediately above the coal seam. The coal contained in the pillars is usually recovered in subsequent operations. Indeed, unless the coal from the pillars can be recovered, room-and-pillar mining is wasteful of coal resources. With the thin seam existing in the Minto field, it is particularly important to remove all the coal possible; and, in actual fact, there is generally about a 98 per cent extraction in the workings outside the area of the main shaft. The necessity for maintaining good support above the main entry usually reduces extraction for the whole operation to about 92 per cent.

Underground operations are carried on at depths of 70 to 125 feet, although operations eventually may have to be carried to depths of 170 feet to mine all possible coal in the area. The entries are driven off the levels every 28 to 40 feet, depending on conditions, and usually extend back about 285 to 300 feet. The miner moves up the entry about 15 feet and begins removing coal.

He digs at right angles to the entry (and parallel to the level), taking out half the thickness of the block of coal and working from the level to the rear of the entry and then retreating again on the other side. Meanwhile, miners in the entries on either side of him are doing exactly the same thing so that eventually all the coal is removed from the area - with the exception of the fifteen foot pillars along the level which are used for roof support and are later also mined.

At the working face, the miners have electric coal drills, explosives, and picks and shovels to dig out the rooms. The coal is loaded into mine cars which are usually pushed to the main entry although occasionally small haulages are installed. No shaft in the Minto area is presently using mechanical conveyors.

In other coal mining areas:- in Canada, the United States, and Western Europe, - the trend has been towards intensive mechanization of underground operations. Indeed, underground mechanization in the United States has held coal prices practically constant for the past decade. A unique achievement in the face of a general price level which has been rising almost continuously.

The Possibilities of Underground Mechanization:

In the brief that the United Mine Workers of America, District 26, presented to this Commission, it requested that a most careful study should be made of the possibilities of mechanizing shaft operations. In addition, Mr. Victor McMann, a coal producer, made a submission to the Commission outlining a type of mechanization which he believed to be feasible for his particular operation. The Commission agreed that this was a matter of the greatest importance, in the light of developments which had taken place in other coal mining areas.

In 1957, Mr. Mathias Wuhr, one of the Commissioners, had visited coal mining areas in West Germany where thin coal seams, comparable to those in the Minto field, were being exploited. Mr. Wuhr had been accompanied by Mr. Victor McMann, and Mr. Joseph Vanderbroeck, mine inspector in the Minto area. Mr. Wuhr suggested that a German expert in the mining of thin coal seams, Mr. Franz Tiefengraber, should be brought to New Brunswick to advise on the possibilities of mechanizing the Minto underground operations. He stated that Mr. Tiefengraber had greatly impressed the New Brunswick party during its visit to West Germany. Both Mr. McMann and Mr. Vanderbroeck agreed that Mr. Tiefengraber had appeared to possess the experience and technical knowledge which would make him extremely well qualified to advise on the situation in the Minto area.

The Commission contacted Mr. Tiefengraber, at Essen, West Germany, and he agreed to come to New Brunswick to prepare a report on the possibilities of underground mechanization. Mr. Tiefengraber spent two months in New Brunswick, from the middle of May to the middle of July, 1959. While in the province, he made a most favourable impression on the members of the Commission and, we believe, impressed coal producers, trade union officials, and government officials, both with his technical competence and the relevancy of his experience to the problems of the Minto area.

Mr. Tiefengraber's report is published as Appendix I. In the main body of this Report, it is intended merely to summarize his findings and to state the recommendations of the Commission.

When the study was made, there were five shafts operating in the Minto area: shafts 27 and 28 of the Miramichi Lumber Company, the shafts of the Victor McMann Coal Company, the Newcastle Coal Company and the A. W. Wasson

Coal Company. In his report, Mr. Tiefengraber states that four of these five shafts can be mechanized to the end of increasing, appreciably, output per man shift.

Mr. Tiefengraber's report on the shafts of the various companies may be summarized as follows:

<u>The Miramichi Lumber Company</u>

(a) <u>Shaft 27</u>

Mr. Tiefengraber does not recommend the mechanization of Shaft 27 because of unsuitable roof conditions. He states: "It (the roof) is very friable and frequently exhibits cracks or fissures which are damp and slippery and extend up to the sub sandstone. As a result, the roof is more or less incoherent, so that a probability exists that, directly after cutting, the roof might settle simultaneously with the coal right up to the sandstone."

(b) <u>Shaft 28</u>

Mr Tiefengraber states that geological conditions in Shaft 28 are suitable for a degree of mechanization. He comments as follows: "Complete mechanization would be somehwat difficult here, since the heavy roof sandstone, in case of eventual decrease of the seam thickness, would so seriously involve and affect the picks of the drum cutting machine (see Plate 1) that further operation of this machine would probably be impossible."

Mr. Tiefengraber recommends a partial mechanization through the use of the SE II type of chain cutting machine (see Plate 2). This machine would operate on top of a panzer conveyor type EB 440 and has a conveying capacity of 75 tons per hour (see Plate 2). The conveyor has a capacity of 16 h.p. It is recommended that its motor capacity be doubled so it could operate over a length of 300 feet.

At the coal face, the overburden is supported by steel props (see Plate 2) which give excellent control of the roof. Steel props are essential to successful mechanization in the Minto area. Indeed, they have had a revolutionary effect on mechanized coal mining in many parts of the world. A steel prop can sustain a maximum pressure of from 40 to 45 tons as contrasted with 16 tons for a wooden prop. Thus, after the coal seam has been cut by a machine, steel props ensure that the roof does not collapse into the cut.

Mr. Tiefengraber recommends that operations should be conducted on a three shift basis. One shift cuts the coal at night and removes the cuttings before the morning shift comes on. The second shift cuts the coal and, at the end of their shift, moves the panzer conveyor. The third shift is responsible for advancing the roof bars and steel props.

On the above basis, assuming operations on two coal faces of 300 feet, Mr. Tiefengraber estimates that 59 men could produce 174 tons of coal a day giving an output of 2.95 tons per man. This is 84 per cent above the present average output for the Minto area in recent years of 1.6 tons per man. In addition, the use of steel props and steel roof bars at the face reduces timbering costs substantially.

The Victor McMann Coal Company

Geological conditions in the McMann shaft are well suited to mechanization. The thickness of the seam, 24 inches, opens up possibilities for the use of the drum cutting machine, provided one could be obtained which would be suitable for Minto seam conditions. Mr. Tiefengraber recommends the SW 670 machine (see Plate 5) with an operating speed of 450 to 900 feet per hour,

depending on the hardness of the coal. If "sulphur balls" were prevalent, this could cause difficulties in the operation of the drum machine. Experience in West Germany, however, had indicated that this problem is not too serious.

The drum cutting machine operates on top of the panzer conveyor and cuts the coal and loads the conveyor in one operation. This, of course, greatly increases productivity. Mr. Tiefengraber estimates that a total of 63 men, working two shifts, could produce 392 tons a day, or 6.22 tons per man. This is on the assumption that two faces of 300 feet each are worked simultaneously and that the drum machine has a speed of 650 feet an hour, cutting to a depth of 8 feet during the cutting shift.

An output of 6.22 tons per man would represent an increase of 288 per cent above the present average of 1.6 tons per man for the Minto area.

If conditions made it impossible to use the drum cutting machine in the McMann mine, then Mr. Tiefengraber would recommend the use of the SE II type of chain cutting machine. Using this machine during three shifts, 58 men could produce 198 tons of coal per day for an average output per man of 3.40 tons. This represents an increase of 112 per cent over the present average output per man.

Whether the drum machine or the chain cutting machine is used, the mechanization of the McMann mine would require the coal produced to be washed.

The A. W. Wasson Coal Company

The geological conditions of the Wasson mine are reported as most satisfactory for mechanization. The seam is described as follows: "(It) has a total thickness of an average 27 to 28 inches, of which, however, only 21 to 22 inches is pure coal. A parting in the upper third part of the seam,

consisting of soft, marly shale in a thickness of 6 inches, divides this into two parts. Above the parting lie 5 inches of coal and below it about 16 to 17 inches."

It is suggested that a chain cutting machine of the type SE II be used to cut out the parting. After this, a drum machine might be used to mine out the coal, provided, of course, the machine will operate satisfactorily. This operation would have two great advantages:

(1) It would not be necessary to wash the coal.

(2) Output would be much higher than if the chain cutting machine alone were used.

On the above basis, 48 men, working two shifts could produce 174 tons per day for an output of 3.62 tons per man. This assumes operations on two longwall faces of 300 feet each.

If it proved not to be feasible to use the drum machines, the use of chain cutting machines alone would enable 62 men to produce 174 tons per day for an output of 2.80 tons per man.

The Newcastle Coal Company

Mr. Tiefengraber reports that the mechanization of the Newcastle mine presents no problems. If it proves feasible to use drum machines, 62 men could produce 348 tons a day for an output per man of 5.61 tons, making the usual assumption of operations taking place on two longwall faces of 300 feet each. The speed of the drum machines is taken as 650 feet per hour.

If the chain cutting machine alone were used, 62 men could produce 174 tons per day for an output per man of around 2.80 tons.

General:

The recommended method of setting up a completely new mechanized operation can be described as follows:

(1) In the middle of a square with sides of 2,400 feet, a shaft should be sunk to the required depth.

(2) The coal should be blocked off by means of the main level, cross levels, and air levels. The main level and cross levels would be six feet high and eight feet wide. The air levels would be four feet high and six feet wide.

(3) Two longwall faces of 300 feet each would be worked simultaneously. Coal would be conveyed away from the face by means of a panzer conveyor and to the shaft by a normal conveyor belt system.

(4) If it proves feasible to use drum machines, a square could be mined out in four years. Assuming a production of 100,000 tons a year and a square to contain 400,000 tons. If chain machines are used, production, each year, would be 50,000 tons and it would take 8 years to mine out a square.

(5) It would be possible to work two additional longwall faces of 300 feet and thus to double the yearly outputs stated above.

(6) It would take about 18 months to get one development into operation.

(7) All mining would follow the longwall retreating method.

(8) The method of raising coal at the shaft would be by means of skip hoisting. This type of hoisting would be satisfactory for any form of mechanization.

(9) The method of mining outlined above would enable a system of ventilation to be installed which would be a great improvement over present methods of ventilation employed in the Minto area. Bore holes would be drilled into the air levels and the air would enter through the shaft, pass along the levels to the face, where it would separate and move down the air levels to the bore holes when it would be sucked up by a ventilator.

(10) In the case of the Victor McMann mine and the Newcastle Coal Company mine, mechanization of any form would necessitate that the coal be washed. Mr. Tiefengraber suggests that these two companies consider building a joint washing plant. It would not be absolutely essential to wash the coal produced by mechanization in the Miramichi and the Wasson Mine.

The Report of Mr. W. P. Dryer:

In August, 1959, upon learning that Mr. W. P. Dryer, thermal power consultant to the New Brunswick Electric Power Commission, was planning to visit Europe on private business, the Royal Commission requested him to go to Germany to see similar mechanization operations to those proposed. Mr. Dryer is an engineer who has had a very distinguished career and considerable experience in the coal mining industry in the United States. Mr. Dryer visited Germany in September, 1959, and gave the Commission a detailed report upon his return. This report is attached as Appendix II.

In summary, the report was most favourable and Mr. Dryer stated that he believed the possibilities for mechanization were most favourable.

(3) Summary

The Report of Mr. Franz Tiefengraber on the possibilities of mechanized underground mines in the Minto area has been given most careful study and consideration by the Royal Commission. As has been indicated, Mr. W. P. Dryer went to Germany for the Commission after studying Mr. Tiefengraber's report and saw the proposed machines in actual operation. His report was most favourable.

In addition, the report has been discussed with coal producers, officials of the Provincial Department of Lands and Mines, and officials of the Department of Mines and Technical Surveys, Ottawa. All stated that they believed the report opened up new possibilities for the Minto coal mining industry.

In view of the request made to the Commission by district number 26, United Mine Workers of America, and the necessity for cutting production costs immediately in underground mines in the Minto field, the Commission makes the recommendations set out below:-

Recommendations:

(1) The Royal Commission on the New Brunswick Coal Mining Industry recommend that the Government of New Brunswick co-operate with the New Brunswick Electric Power Commission, the New Brunswick Coal Producers Association, and local 7409 of the United Mine Workers of America to carry out a mechanized operation on a trial basis. A temporary organization could be set up to collect the necessary funds from interested parties and to administer the operation.

(2) As mechanized coal mining is a highly technical operation, the Commission recommend that an experienced and qualified coal mining engineer should be hired to supervise the installation of the equipment and to oversee the trial period of operation.

Note on Coal Preparation:

In the Minto area, at the present time, both D. W. and R. A. Mills Limited and the Avon Coal Company Limited have constructed coal washing plants. These plants have each been designed to prepare 425,000 tons of coal a year, assuming operations are conducted on the basis of three shifts a day. Thus the total annual capacity of the two plants is 850,000 tons or nearly enough to meet the present output of the field.

Since their construction, these washing plants have operated well below capacity. At the public hearings of this Commission, a representative of the Mills Company stated that his firm was prepared to wash coal for other producers on a custom basis. In the years ahead, the Commission believes that a much higher proportion of New Brunswick coal will have to be washed if it is to meet competition from other fuels. With this in view, the Commission recommends that coal producers examine the possibilities of having the existing plants wash their coal on a custom basis.

As regards the construction of additional washing capacity, a decision in this regard should be delayed until the results of a trial mechanization program are complete and its implications for the field are studied in detail. The total amount of washing capacity required in the future, and its location, the type of plant, and the method of operation are all questions which can only be settled when the data regarding the possibilities of underground mechanization are complete.

CHAPTER IV MARKETS

(1) Introduction - Past and Present Trends

Over the years, it can be shown that the effective demand for New Brunswick coal has largely been determined by the manner in which the price-quality relationship of coal was maintained in competition with other sources of energy. Thus, prior to World War II, coal had a decided advantage over such locally produced fuels as wood; and its geographical location provided a price-quality advantage over such imported fuels as oil in local markets. The results of this set of circumstances provided that the demand for energy, both in the province and the Atlantic region, was largely supplied by coal. This trend remained substantially so until the early part of the 1950's when some 60% of the regions' total energy requirements came from coal. At this point, however, the degree and extent of competition from oil increased and, from all the information available, is likely to further increase in the years ahead.[1]

The significance of this for the New Brunswick industry is that the apparent regional demand for coal as a source of energy has been stabilized in recent years, and should at best remain so for at least another five or six years. If this regional picture is pessimistic, than a consideration of local markets in this perspective produces even worse results. With the construction of a new oil refinery in the province, the rate of oil-coal competition is likely to become particularly severe, and thus the problem facing the industry is to meet this competition on a price-quality basis.

Traditionally, this has been the chief marketing difficulty of the

[1] See, "Canadian Energy Prospects" by John Davis, prepared for the Royal Commission on Canada's Economic Prospects, 1957.

TABLE VII

DISPOSITION OF NEW BRUNSWICK COAL, 1949-1958

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
Production	540,806	607,116	653,439	742,823	721,252	781,271	877,838	983,482	976,597	787,949
Shipped to consumers:										
– industrial and institutional, etc.	234,912	279,035	290,620	366,158	346,628	445,130	453,231	506,384	513,522	513,078
– N. B. E. P. C.	134,080	147,439	174,174	211,695	186,250	145,858	209,337	272,671	266,606	98,522
– Railways	107,747	114,728	131,973	108,292	112,123	95,283	106,541	99,097	36,040	14,469
– Exported – Quebec	2,735	742	933	65	839	25,920	25,184	23,152	23,539	109,122
– Exported – U. S.	44,377	51,980	48,875	52,880	64,157	54,709	78,681	84,183	82,182	72,245
Totals*	523,851	593,924	646,576	739,090	709,977	766,900	872,974	985,487	921,889	807,436

* Disparity between production and shipments is accounted for by shipments to or from stock piles.

industry - to maintain already developed markets rather than developing new ones. In the past, the most prominent single trends were the loss of the railway markets to dieselization and oil, and the almost corresponding increase in the importance of thermal power generation as a market for coal. This trend, or combination of trends, has carried on into the post-war period and, as TABLE VII illustrates, has maintained the industry's dependence upon what might be described as a "purely local market."

It is apparent from these statistics that the trends developing in recent years point to the ultimate disappearance of one market, the stabilization of another and to two or three areas of questionable potential. Looking at these various markets in turn suggests, in the first place, that the railway market will disappear completely for all practical purposes. On the other hand, the industrial and institutional market has more than doubled in the decade, but with no extensive expansion in the last three years. This market can be considered as providing an outlet for coal in the long run which will increase slowly, but with increasingly severe competition.

In the case of export markets the future is uncertain: in Quebec the competitive position of Minto coal is maintained largely by the existence of a more advantageous freight subvention than is allowed Nova Scotia coal. The United States market, however, is relatively safe from competitors but depends largely on the activities of one pulp and paper company. Thus, neither export market can be considered as potentially "mushrooming" markets for the industry to exploit at its convenience.

Within this framework, two conclusions are apparent from the trends which have been in evidence over the past few years. The long-run trend points

to the maintenance of markets for the industry only with increasingly severe competition from competitors. And since users of the lower-grade bituminous coals are becoming more and more inclined to select in terms of cents per million B.T.U., most of this competition must be in the price area.

The second trend is of more short-run importance:- for a certain segment of the industry the New Brunswick Electric Power Commission market appears to be the focal point of all decisions to produce and sell. In years when Commission requirements are down, producers are forced into the local market, and directly and indirectly into export markets. Given the apparent increasing inelasticity of these latter markets, and the inherent potential of severe fluctuations in Commission coal requirements,[2] there exists the corresponding potential for rather significant year-to-year movements in the amount of employment and output in the Minto area.

(2) <u>The Future Position</u>

<u>General</u>:

According to the Royal Commission on Canada's Economic Prospects, the 'time of the troubles' for Canada's coal industry will be from the present to about 1965, a period of declining demand. After that, anticipated increases in the demand for coal for coking and metallurgical purposes combined with requirements for power generation will provide sufficient markets to absorb domestic output. Markets for space heating and transportation will virtually disappear, largely due to the lower prices and the relative greater efficiency of competing fuels.[3]

2 The output of New Brunswick Electric Power Commission hydro installations at Tobique and Beechwood will vary significantly according to the degree of rainfall, runoff and storage which may exist from time to time.

3 See, "Canadian Energy Prospects" by John Davis, prepared for the Royal Commission on Canada's Economic Prospects, 1957.

For New Brunswick coal, this forecast appears to be particularly appropriate:- the next five years are likely to be difficult for two reasons:

i) the output of the Irving Oil refinery will be coming into the market during 1960 and, until its market position is stabilized, is likely to bite deeply into present coal markets for space heating, industrial and institutional consumption.

ii) a key market - the New Brunswick Electric Power Commission - has apparently stabilized its requirements in the vicinity of 150,000 tons of coal annually, and even this figure will be subject to wide variations. From all available information, it would appear that there is not much short-term growth potential here as there are indications that future power requirements may well be met through additions to a Saint John plant burning oil and the Beechwood hydro installation.

After, and to some extent before, 1965 growth in industrial markets will assist in the maintenance of output. After 1965 this market should improve considerably as regards coal· oil should be less competitive due to world demand catching up with supply and the output of the local refinery settled in more or less stabilized markets. In addition, expansion of output in coal utilizing industries, such as pulp and paper, will be providing more extensive markets.

There is, however, little likelihood that Minto coal will enjoy the exploitation of expanding coking and metallurgical markets in the post-1965 period. Normally, Minto coal is not considered ideally suitable for coking or metallurgical use due to its relatively high sulphur content. Although Minto

coal can be coked, there is little possibility of sufficient markets for coke developing to justify the process.[4] However, should the New Brunswick economy undergo two major developments (for which there is great potential), two possible markets could open up. The development of the province's low-grade manganese ores by the Udy process would involve the utilization of some 30,000 - 75,000 tons of low-grade bituminous coal annually, as a reducing agent mixed with American anthracite. Officials of the Strategic Materials Corporation Limited have indicated that Minto coal would be suitable for this purpose, and thus an assured market would be opened - one relatively safe from its chief competitor, Nova Scotia coal.

An additional market for some 70,000 tons of coal per year may well be possible at some point in the future, should base metal developments in the Bathurst - Newcastle area proceed to the smelting stage. This, however, would be dependent upon the type of smelting process involved, but should the Avonmouth process, for example, be used Minto coal could be coked to 85% carbon content economically.

It should be noted that these coking and metallurgical possibilities are only possibilities, and it would be unrealistic to include them as firm markets in any analysis which may lead to policy recommendations for the coal industry. Thus, for the practical purpose of assessing the future market position of the industry, it is assumed that there will be no utilization of Minto coal for such purposes.

The Local Market:

The local market, that is the market within the provincial

[4] For details concerning the non-fuel uses of Minto coal, see Chapter V.

TABLE VIII SUMMARY OF N.B. COAL STATISTICS – OUTPUT, EXPORTS, INTERPROVINCIAL SHIPMENTS AND IMPORTS, AND COAL AVAILABLE [illegible] CONSUMPTION – 1949-1958

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
CANADIAN COAL										
N.B. OUTPUT	540,800	607,116	653,439	742,823	721,252	781,271	877,838	988,266	976,597	790,719
RECEIVED FROM NOVA SCOTIA	567,883	616,993	625,909	583,952	520,528	432,388	475,493	478,073	442,917	[illegible]
MINE SHIPMENTS TO OTHER PROV'S. (MOSTLY P. Q.)	3,883	2,244	4,498	3,366	1,510	26,417	26,406	24,159	23,961	109,122
SHIPMENTS TO U.S.A.	41,895	51,980	48,875	52,880	64,157	54,709	78,681	84,183	82,182	72,245
IMPORTED COAL										
FROM U.S.A.	869	1,302	607	514	451	460	462	396	259	1,630
FROM GR. BRIT.	19,694	21,894	19,811	15,584	7,480	–	–	–	4,457	4,6[illegible]
AVAILABLE FOR CONSUMPTION	1,083,474	1,193,081	1,246,393	1,286,627	1,184,044	1,132,993	1,248,706	1,358,393	1,318,087	907,2[illegible]

boundaries, has been, and will continue to be, the natural market for the Minto coal fields. To state the obvious, the size of this, or any, market depends on the number of users and the extent of the competition: and here the number of users is decreasing and the competition is increasing at an even faster rate.

Traditionally, the local market has absorbed about 85% of the total output of the Minto field. Since 1950, however, the average dependency on the local market has been more in the order of 90% of the field's output with the exception of 1958, when over 20% of total mine shipments were outside the province. However, over the years this portion of the industry's output has met only about one-half to three-quarters of the total coal requirements of the New Brunswick market. The remainder has been supplied by imports, mainly from Nova Scotia mines. The trend, since 1949, in this respect has been for more and more of the total market requirement to come from the local industry - from less than 50% in the early 1950's to nearly 70% in the past few years.

In other words, in addition to markets already held by the industry, there is a further market area involving from 300,000 to 400,000 tons of coal annually within range of the industry. The extent to which this market can be reached will, of course, be subject to the extent to which the industry can meet competition from Nova Scotia coal and from oil. Before examining the future position of the industry in the various segments of the local market, the two assumptions made should be reiterated: first, that the railway market will virtually disappear and secondly, that no coking or metallurigcal markets will be available for Minto coal.

(a) The Domestic Retail Market

The domestic retail market for coal for space heating appears to have stabilized over the past few years, and there is every indication that the growth potential here is extremely limited. Notwithstanding price, consumers seem to make decisions against coal on the basis of convenience, cleanliness and other factors.

TABLE IX

Principal Heating Fuel Used in New Brunswick Households[1]

YEAR	COAL & COKE	OIL[2]	WOOD	OTHER	TOTAL
		- thousands of households -			
1953	27	36	59	2	124
1954	23	27	68	-	118
1955	32	30	63	-	125
1956	33	37	58	-	128
1957	28	46	57	-	131
1958	12	57	57	-	126
1959	10	61	58	-	129

Principal Cooking Equipment Used in New Brunswick Households[1]

YEAR	ELECTRIC STOVES[3]	WOOD OR COAL	OIL[2]	OTHER	TOTAL
		- thousands of households -			
1953	21	67	20	16	124
1954	19	81	15	3	118
1955	21	82	18	4	125
1956	27	72	23	6	128
1957	24	74	28	5	131
1958	32	58	26	10	126
1959	34	60	24	11	129

[1]Source: Estimates published by the Dominion Bureau of Statistics, Ottawa and based on special sample surveys.

[2]Includes Kerosene.

[3]Includes combination electric and coal or wood stoves.

The estimates contained in the above table tend to bear this out:- over the past seven years coal has suffered greatly both as fuel for heating and for cooking purposes, losing out to both oil and electricity. Thus, the logical conclusion is that these trends will continue in the future despite the presence of some year to year deviations from the normal rate of market loss for the coal industry. Perhaps the most striking data from this table is the steady persistence of wood as a heating fuel over the past few years. While this is somewhat contrary to national trends, it is a situation likely to be maintained as long as there exist in the province some 22,000 farms and a great number of related marginal economic units.

However, the continuance of such trends in the domestic retail market is not likely to have a proportional effect on the province's coal industry, for the industry has made little attempt to cultivate this market, mainly due to the relatively unsuitable nature of Minto coal for domestic heating purposes. Thus, the gradual shrinking of these markets will have more effect on the Nova Scotia coal industry, by reducing its markets generally in New Brunswick, and particularly in the Saint John and Moncton areas.

There is, however, one portion of this market which will remain firm and even expand as long as present policies remain unchanged. These are the requirements of the Provincial Government for fuel for heating purposes. In this respect, the United Mine Workers, district number 26 in their brief to the Royal Commission suggested that the Provincial Government give preferential treatment to Minto coal as regards the Government's fuel needs. Insofar as the Commission was able to determine, such treatment is already being given to the Minto industry wherever possible by the Government or Agencies directly under its jurisdiction. TABLE I would seem to indicate this.

TABLE X FUEL CONSUMPTION FOR HEATING - NEW BRUNSWICK GOVERNMENT

CLASSIFICATION	COAL		BUNKER 'C' OIL		LIGHT FURNACE OIL		STOVE OIL		WOOD	
	TONS OF COAL CONSUMED	COST OF COAL ($)	GALS. OF BUNKER 'C' OIL CONSUMED	COST OF OIL ($)	GALS. OF LIGHT FURNACE OIL CONSUMED	COST OF OIL ($)	GALS. OF STOVE OIL CONSUMED	COST OF OIL ($)	CORDS OF WOOD CONSUMED	COST OF WOOD ($)
1 GOVERNMENT BUILDINGS, FREDERICTON - TEN BUILDINGS	255.31	3,831.51	294,834	25,238.26	9,059	1,494.73	-	-	-	-
2 PROVINCIAL HOSPITALS - FOUR HOSPITALS	13,580.50	169,137.83	50,419	6,635.14	336	64.92	-	-	-	-
3 NEW BRUNSWICK LIQUOR CONTROL BOARD - STORES AND WAREHOUSES - TWENTY-TWO BUILDINGS	-	-	-	-	75,903	13,363.76	-	-	-	-
4 DEPARTMENT OF LANDS AND MINES - THIRTY-FOUR BUILDINGS	-	-	-	-	41,018	7,702.17	-	-	-	-
5 PROVINCIAL BUILDINGS - FOUR	265.64	4,552.08	-	-	2,160	4,363.71	15,887	3,004.37	-	-
6 GOVERNMENT GARAGES, HIGHWAY GARAGES, AND SNOW SHEDS - NINETY-ONE BUILDINGS	888.03	13,884.58	-	-	238,089	42,253.47	55,003	14,050.39	213.5	3,777.00
7 MISCELLANEOUS *	1,994.71	11,584.00	-	-	-	-	6,469.3	1,227.55	47	822.50
8 TOTALS - FOR 173 BUILDINGS:	16,984.19	202,990.00	345,253	31,873.40	366,565	69,242.76	63,059	18,282.31	260.5	4,599.50

* INCLUDES MONCTON TECHNICAL SCHOOL, TEACHERS' COLLEGE, WOODSTOCK TRAVEL BUREAU, MOTOR VEHICLE BRANCH (ST.STEPHEN), HANDICRAFT BUILDING (FREDERICTON), STORAGE SHED (CHATHAM), AND OUTBUILDINGS (CHIPMAN).

From this table, it is evident that of the Government's total fuel bill, some 62% went to the coal industry, over 97% of which was for the purchase of Minto coal. However, when other fuels are converted to coal equivalents,[5] then some 71% of this potential market is being supplied with coal from the Minto field.

However, the bulk of Government coal purchases constitute the requirements of provincial hospitals, with substantial quantities of oil being consumed in government buildings, particularly in the Fredericton area. Theoretically a 100% conversion to coal would provide an additional market of some 7,000 tons annually for the Minto area. However, such a conversion would not be practically possible due to some specialized requirements, handling and storage problems, and to some extent to the location of government buildings in either inaccessible or business and residential areas.

(b) The New Brunswick Electric Power Commission Market

In its brief to the Royal Commission, the New Brunswick Electric Power Commission estimated their coal requirements for the period 1959 to 1968, excluding the new Saint John thermal unit, to average approximately 120,000 tons annually on a minimum basis. These estimates would approach an average of 190,000 tons per annum given the Commission's estimates of a 25% increase in power generation above such minimum requirements. Thus, their suggestion of a stabilized requirement in the vicinity of 150,000 tons annually is quite

[5]Conversion Data:
Minto coal = 11,610 BTU/LB
Bunker 'c' oil = 183,000 BTU/IMP. GAL
Light furnace oil = 170,000 BTU/IMP. GAL
Stove oil = 166,000 BTU/IMP. GAL
Wood = 20,000,000 BTU/CORD. This is the average for air-dry red and sugar maple. Also the heat value for ash. One cord = 3,440 lbs. - also an average.

reasonable, but is adequate for the industry only if it is assumed that the industry will maintain its other markets. In addition, it should be noted that even this figure will undoubtedly be subject to annual fluctuations by as much as 60%, depending on rainfall and annual river levels.

If the requirements of the Saint John plant were included in these forecasts then the average annual requirement would be in excess of 300,000 tons - a figure beyond the present capabilities of the coal industry if they are to hold their other customers. Again, this would only be true to the extent to which the industry is successful in holding these markets. Thus, in preparing minimum market estimates, the Royal Commission makes the assumption that oil is used in the Saint John plant on an economic basis, assuming the current level of coal prices. In their brief to this Commission, the New Brunswick Electric Power Commission indicated that the use of oil involved very substantial savings.

In brief summary then, it can be concluded that the coal market for thermal power generation will average some 140,000 - 150,000 tons annually over the next decade, subject to considerable annual fluctuations as water levels change and as anticipated additional units are added at Beechwood and at Saint John. Since these fluctuations will undoubtedly cause a degree of difficulty for the coal industry, the Commission feel that every possible effort should be made by the New Brunswick Electric Power Commission to reduce their impact on the coal industry. Thus, if the New Brunswick Electric Power Commission could assess its annual requirements prior to the commencement of the year, the industry could plan accordingly. In this connection, it is strongly felt that coal should be purchased on a tender

basis in accordance with certain required specifications, both as regards annual and additional monthly or weekly tonnages. This system of purchasing would permit a more favourable competitive environment in the industry and would provide incentive for both the production and purchasing of better quality coal. In addition, in order that the New Brunswick Electric Power Commission may avoid the problem of poor quality coal during periods of peak market demand, it is felt that provision should be made for the storage of reasonable amounts of coal at power plant sites.

(c) Industrial and institutional market

As Table VII above indicates, the New Brunswick coal industry has, in the past decade, become more and more dependent upon the industrial and large institutional market. At present, some 75 - 80% of the field's total shipments have been to this area, and if output and employment in the industry are to be maintained, this trend must be continued in the future. Excluding New Brunswick Electric Power Commission requirements there is considerable growth potential in this industrial market for fuels, but the problem arises as to the percentage of this market which can be held by the New Brunswick product. It is thus in this market that Minto coal will face the strongest competition, both from Nova Scotia coal and locally refined oil.

First, the competition from Nova Scotia coal. Generally, coal from the Minto field is classified as high volatile "A" bituminous and, as such, ranks well with most Nova Scotia produced coal. However, it is inferior in grade with more ash, more sulphur and as received, generally with more moisture. As a competitor in the New Brunswick market, Nova Scotia

coal has long had a foothold and in the last decade has generally been successful to the extent of some 300,000 to 500,000 tons annually.

Thus, coal imported from Nova Scotia has been the chief competitor of the Minto product in the local market, and the industry has only been able to compete by offering a fairly substantial price differential to offset its inferior quality position. Since 1940, this price differential has increased steadily from its low point near equality in 1940 to a differential of over 30% during the past few years. This situation has been the result of the fact that production costs in the Nova Scotia industry have been rising at rates in excess of those for the Minto industry.

As would be expected, there has been a corresponding, but not proportionate, falling off in sales of Nova Scotia coal in the New Brunswick market. However, there is no information to indicate that this has resulted from local exploitation of rising price differentials. Rather, this market decline seems largely to have been caused by the gradual shrinkage of the domestic retail market together with lower levels of demand from the railways. This would tend to indicate that factors other than price may be the prime determinant of the level of sales of the Nova Scotia product in the provincial market.

In 1958, some 291,000 tons of Nova Scotia coal were shipped into the province, the decrease from 1957 being attributed to the loss of railway markets to oil. Of this amount, approximately 100,000 tons went to the pulp and paper industry in the northern and eastern parts of the province, and another 60,000 to 70,000 tons were sold to industrial consumers, largely in the eastern portions of the province. The remainder was apparently

absorbed by the domestic retail market.[6] This latter market, along with a few industrial consumers, is considered by the local industry to be practically inpenetrable due to the unsuitable characteristics of Minto coal: relatively high sulphur content, for example.

However, the bulk of the industrial market is considered to be well within the competitive range of the Minto producers, but with particularly strong competition in the Saint John and Chatham areas. On the basis of the information available the Commission is inclined to agree that Minto coal is competitive in all these markets held by the Nova Scotia product, except where special circumstances such as low sulphur content requirements or special handling facilities are involved. Although unwashed Minto coal has a calorific value nearly 15% less than the average Nova Scotia product, its price in the cars is only about two-thirds as high, thus providing a price differential of nearly 15% when sold on a cents per B.T.U. basis. This competitive advantage is being reduced somewhat by the fact that freight rate increases have been greater for the New Brunswick product than for Nova Scotia coal in the same market area. Although the impact of discriminatory increases of this type is not yet a substantial problem, every effort should be made to avoid their reoccurrence in the future.

Thus, in the provincial market there exists a substantial price differential, which is likely to persist for some time, and which is sufficient to enable the industry to compete advantageously with coal imported from Nova Scotia. In addition, it is highly probable that an intensive sales campaign by the industry would succeed in making significant inroads into those industrial and institutional markets now supplied from Nova Scotia.

[6] These data are estimates based on information supplied by the industry.

In this respect, the coal industry has been prone to looking at its market in terms of a few large buyers, and accordingly few intensive attempts have been made to sell the large number of smaller retail and institutional customers. In the years to come, and particularly until the middle sixties, the industry will be forced to alter its sales techniques in these markets if it is to compete with the rapid increase in competition from light and heavy fuel oils.

The other competing fuel in the industrial and institutional market - residual oil - will provide a more difficult problem. This type of inter-fuel competition has been increasing at a rapid rate and will undoubtedly continue to do so in the face of the current world oil surplus and the expanding refinery capacity of the Atlantic region. The market impact of this competition will likely be twofold:- additional energy requirements in the province are likely to be supplied to a greater extent by oil, and current requirements now involving coal can be maintained only through some fairly significant price reductions.

In recent years, the demand for oil in the Maritime Provinces, and in particular the demand for heavy residual oils, has been increasing at a rate of about 8 - 10% per year. On the supply side, the bulk of this demand is supplied by the Imperial Oil refinery at Halifax, with the remainder being imported in refined form. Since it is this residual oil which provides the main competition for Minto coal in the industrial and institutional market, the Commission's considerations were largely confined to this product. Thus, if the status quo as regards production and imports were to be maintained, the anticipated demand increases would result in ample markets for both coal and oil.

However, with the commencement of operations of the new Irving Oil Refinery at Saint John during 1960, the entire residual production picture as it effects the coal industry will be changed. This refinery is expected to produce approximately $2\frac{1}{2}$ million barrels of residual oil annually, or the equivalent of approximately 700,000 tons of coal. However, when viewed in the perspective of the province's current supply position, the impact of this residual output is not nearly so adverse.

Although no precise data is available as regards the production and distribution of residual oil for the province, Commission estimates indicate that over one-third the annual residual output of the refinery will be required to supply markets currently supplied from imports. In addition, should the New Brunswick Electric Power Commission thermal plant burn oil piped hot from the refinery, then the equivalent of nearly 900,000 barrels of Bunker C oil would be used annually. Thus, the net impact of the refinery, in terms of the amount of new competition for coal, is likely to stem from the existence of less than 500,000 - 600,000 barrels of residual oil a year which could be considered surplus to current markets. In other words, something in the vicinity of 150,000 tons of Minto coal equivalent, if the worst circumstances are assumed.

However, an impact of this magnitude is dependent upon some 600,000 bbl. of pitch being consumed by the New Brunswick Electric Power Commission, whose thermal plant cannot be expected on line before mid-1961. With the refinery in operation prior to this for slightly over a year, the extent of market competition will be considerable in the immediate future, even allowing for less than capacity operation by the refinery. Therefore, the coal industry

will be faced with two problems:- one, involving rather intensive competition to mid-1961, and the other entailing some reduction of market growth potential up to about 1965 or 1966. In addition, it is obvious even at this stage that the competition between the two regional sources of residual oil will increase in intensity, and will last for as long as it takes the market to expand to absorb the surplus supply, or for a period lasting from three to five years. With each producer aiming at bulk purchasers, the coal industry's markets on tide-water are particularly vulnerable. In fact, there are indications at the present time that this has already become a problem on the province's north and northeastern shores.

The economics of landing oil in this part of the province is somewhat complicated due to the large number of variables involved, but there are indications that Bunker C oil could be placed in burners in these areas at very low prices. To compete, Minto coal would have to be delivered at substantially reduced prices.

The Export Market:

The export market for New Brunswick coal has largely consisted of Quebec and Maine. In Quebec, purchasers have been mainly the pulp and paper companies, and almost the total export to the State of Maine goes to one pulp and paper company near the border. The competitive position of the industry in these markets over the next few years will be largely determined by two variables:- In the New England States, any significant market expansion would appear to be possible only with a substantial reduction in the price of coal, in order to compete with oil. The brief of the United Mine Workers, district

#26, suggested that markets should be developed in this part of the United States, and the Commission feel that the suggested mechanization program offers a solution consistent with their recommendation, since no type of subvention policy can be applied on coal moving to this market.

The determining factor in the maintenance of the industry's position in the Quebec market, is the extent to which Federal Government subvention policy will be continued. At present, the industry is selling in excess of 100,000 tons in this market by virtue of the fact that Minto coal receives a differential subvention, which reflects the fact that New Brunswick coal requires a higher subvention than Nova Scotia coal in order to make it competitive with imported United States coal. As long as the acceptance of this principle continues, the industry should be able to maintain its position. There is, however, the additional fact that even under these circumstances the extent of competition is likely to increase substantially. With increased movements of natural gas into Quebec, both oil and Nova Scotia coal will be forced to compete more intensively for markets. As oil loses ground to natural gas it will tend to move into markets previously considered marginal, and both Nova Scotia and New Brunswick coal will be affected.

(3) Summary

In summarizing the future position of the industry, it should be stressed that economic forecasting is at best a hazardous occupation, but with the conglomoration of inter-related variables present in this case the problem becomes even more pronounced. However, several trends are clearly discernible:- the railway market will all but disappear completely, the

domestic retail space-heating market offers no hope for expansion with the increasing availability of oil. Generally, current trends indicate that, although the total demand for energy is increasing, the potential market for coal is decreasing and the competition for it increasing.

In industrial and institutional markets trends are mixed: there are substantial markets open to the industry which involve competition with imported coal at existing coal prices on a favourable basis. These markets consist mainly of a large number of small buyers, but their aggregate consumption may well run to over 150,000 tons of coal annually. However, intensive and extensive selling will be required by the industry. There are at present a number of institutions within 100 miles of Minto burning imported coal at prices of nearly $20 00 per ton, and some utilizing oil at prices over $7.00 per barrel; these people must be convinced that on a cost-quality basis Minto coal would be an economically feasible fuel.

Although the industry's product can compete with imported coal at current prices, to compete with oil, prices must come down. In brief, the future position of the industry can be considered in three stages.

The first, from the present to the end of 1961, will involve competition with surplus residual oil in a period prior to any possible price reductions due to mine mechanization, and reduced New Brunswick Electric Power Commission requirements should the Saint John thermal plant consume oil. The second stage, from 1962 until 1965 or 1966, will involve continued competition from oil, but on a less severe basis due to the growth in provincial and regional demand for heavy fuels, and the development of a degree of price flexibility from the mechanization of shaft mines. In the final, or post-1965,

period the demand for coal due to industrial growth and for the generation of thermal power should be sufficient to maintain output at current levels.

At this stage some comment should be made on two rather glaring points which will otherwise provoke unnecessary discussion. First, as regards the Saint John thermal plant: for its considerations, the Commission chose to select that set of assumptions, consistent with reality, which produced the worst possible theoretical market position for the New Brunswick coal industry. In doing so, this involved assuming that the Saint John plant would burn oil, and that additional power requirements in the early and middle 1960's would be met by adding to the Saint John and Beechwood installations. In addition, the assumption was made that no markets would result from manganese or base metal developments in the province. It is the Commission's view that if any one of these assumptions prove wrong then the marketing problem is solved; should all of them be wrong, then the problem will be to restrain production to a level consistent with estimated coal reserves.

The second point which deserves some comment relates to the possibility of competition from other energy sources such as atomic energy and tidal power. The Commission feel that the possibilities of these sources becoming a determining factor in the next decade are extremely remote. After 1970 the potential is great, but a consideration of the New Brunswick coal industry with this in mind, although interesting, would be somewhat academic at this stage.

Recommendations:

(1) If the price of coal can be reduced, the lower price plus the Federal subvention of $1.73 per ton on coal used for power generation, should open

up excellent possibilities for the construction of a 50,000 K.W. thermal generating plant in the Grand Lake area producing low cost electric power. If this plant were located near a pulp or paper mill to which it could sell both steam and power, an extremely economic industrial combination would be located. This would greatly assist in solving both the marketing problem of the New Brunswick coal industry, and the problem of industrial diversification in the Minto area. This Commission consider this a matter of the greatest significance, and therefore recommend that it be given most careful study by the New Brunswick Electric Power Commission and by the Department of Industry and Development and other Provincial Government development agencies.

(2) Over the next few years the Quebec market will be of vital importance to the coal industry, and thus every attempt should be made to preserve and expand the present Federal subvention policy in that area. The problem of subventions is dealt with in detail in Chapter VII.

(3) The Commission feel that the potential market for coal in New England deserves intensive consideration, and therefore recommend that one of the first tasks of the Coal Industry Advisory Board be the investigation of markets in Maine, in particular, and of the New England States generally.

(4) The Commission believe that the industry should attempt to more fully develop the local market, and it is therefore recommended that the sales promotional activities of the industry be expanded. It is felt that an effort should be made to promote the sale of New Brunswick coal on an industry wide basis.

This could be done either through the coal operators themselves or in conjunction with the Coal Advisory Board recommended in Chapter II. This agency might even provide a measure of financial or financing and technical assistance to small consumers wishing to install coal-burning facilities.

(5) The Commission believe that the New Brunswick Electric Power Commission has a responsibility, as a large consumer, in the promotion of stability in the industry, and therefore recommends, that its purchases be made on a tender basis, after requirements have been assessed, and that it make every effort to provide storage facilities at plant sites in order to reduce the impact of seasonal production fluctuations on certain segments of the industry.

(6) The Commission believe that the Government of New Brunswick should provide wherever possible, a measure of preferential treatment - possibly to the extent of 10% - to the Minto coal industry in purchasing fuel for heating purposes.

CHAPTER V COKE AND NON-FUEL USES OF NEW BRUNSWICK COAL

The Commission studied the possibilities of utilizing New Brunswick coal for coke and for non-fuel uses. The published material was reviewed and discussions were held with provincial and federal officials who were acquainted with the subject. In general, at the present time, it is impossible to forecast with any degree of confidence the future demands which will develop for New Brunswick coal for purposes other than steam raising.

The Curran-Knowles Process:

In 1940, an extensive series of tests were carried out on New Brunswick coal by the Fuel Research Laboratories of the Bureau of Mines, Ottawa, and the results were compiled in the document entitled Fuels Division Report No. 148. This investigation showed that New Brunswick coal is suitable for the manufacture of domestic coke by the Curran-Knowles process.

The yield data for the marketable products of this particular carbonization process were:-

(1) Yields per ton of coal charged

Coke yield (dry basis)	77.4%
Breeze	6.7%
Coke less breeze	70.7%

The breeze can be marketed or re-charged to the process.

(2) Tar yield - The tar yield is estimated at 10 imperial gallons per ton of coal charged.

(3) Surplus gas - The yield of surplus gas is estimated at 4,000 cubic feet of 500 B.T.U. gas per ton of coal carbonized. The sulphur content, as hydrogen sulphide, is 2,050 grains per 100 cubic feet of gas.

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Since New Brunswick is without an integrated chemical industry composed of chemical processors and convertors, the tars would have to be marketed as wood preservatives or shipped in tank cars to firms in Central Canada. Informed opinion indicates that a New Brunswick product would not have any particular qualities which would enable it to break into established markets. At the same time, the competition of other fuels would make it extremely difficult to sell surplus gas to industrial users, unless the coking operation were located close to a large industrial centre. Thus, the feasibility of an industry based on the carbonization of New Brunswick coal would rest, fundamentally, on the coke which could be produced.

The 1940 tests showed the following proximate analysis of washed coal and coke from the Minto area:-

	Ash %	Volatile Matter %	Fixed Carbon	Sulphur	Fusion Point of Ash
Coal, washed	10.8	33.4	55.8	5.4	1960°F.
Coke (run-of-oven)	14.5	1.6	83.5	4.4	1930°F.

Run-of-oven coke from New Brunswick coal was shown to compare favourably, as regards thermal properties, with American anthracite coal and with by-product coke from slot type ovens. There seems to be little doubt that it could replace imported coke in the local market as well as imported anthracite. In 1940, however, when the testing was done, these markets represented sales of about one million dollars in New Brunswick. In the intervening years, due to the competition of fuel, oil, these markets have declined so considerably that it is very doubtful if a coking industry could subsist upon them.

Metallurgical Coke:

The other possibility for coke sales rests on the development of a metallurgical industry in New Brunswick based on the Province's deposits of base metal ores. At Avonmouth, in Great Britain, the Imperial Smelting Company has developed recently a thermal-type blast furnace zinc smelter which utilizes coke to produce most of its thermal requirements. If a zinc smelter is located in New Brunswick, it is quite possible that it would be based on the above process.

The possibility of using coke produced from New Brunswick coal in a thermal-type zinc smelter was raised with representatives of the Extraction Metallurgy Division, Department of Mines and Technical Surveys, Ottawa, and the following is part of a statement that was furnished to the Commission:-

> The situation with respect to process coal requirements is not known to us except through the published literature. From this it appears that the ash and sulphur content of the New Brunswick coals, while high, apparently would be acceptable. The physical requirements of the coke are stated as "the preference being for a fairly hard metallurgical coke." However, it appears that both gas cokes and foundry cokes have been used successfully. The New Brunswick coals will probably produce a suitable coke, but the tonnages required are too small to justify the construction of conventional slot-type ovens. To produce 120 tons of zinc per day about 160 tons of coke would be required to be produced from about 250 tons of mine-run coal. A minimum outlet of about 1,000 tons of coal per day would be necessary for the use of the slot-type oven. It is possible, however, that quantities of the required order of magnitude could be produced economically by special methods such as the sole-heated Curran-Knowles Coke Oven, and that this process would produce suitable coke from New Brunswick coals.

The Commission believes that the possibilities of utilizing coke from New Brunswick coal should be kept under review by the Department of Lands and Mines and that the Department of Mines and Technical Surveys

should be asked to carry out such tests as may be necessary. At the present time, it is, of course, impossible for the Commission to prepare any realistic estimates of the demand for coal which could accrue from this source.

Chemical Products Based on Coal:

Coal is, of course, composed principally of the important elements carbon and hydrogen which are utilized by many chemical industries. The mere availability of these elements, however, does not warrant the production of chemicals from coal. Coal will be used only if it can furnish these elements cheaper than they can be obtained from the other hydrocarbons. At the present time, there is no evidence that chemical products based on New Brunswick coal could compete in Canadian markets with products manufactured from oil and natural gas.

An additional non-fuel use for coal is still in the early stages of investigation and development, but could conceivably provide an outlet for substantial amounts of Minto coal. This process, patented by the Curtis-Wright Corporation, involves mixing quantities of finely ground coal with creosote and tar to produce surface pavement for highways. Although the process is still being tested by the State of Kentucky Department of Highways, it would appear that there are two disadvantages to an application of this type - both of which are economic in nature.

First, it would appear to be higher in cost than the asphalt normally used; and secondly, the large coal input is in the tar which is produced as a by-product in a coking process. Thus, it would be necessary to develop markets for coke in order to obtain tar and creosote at by-product prices.

Conclusion:

The conclusion of the Commission is that it would be unrealistic to assume that significant new uses will develop for New Brunswick coal in the near future. The demand will arise primarily from its present uses:- thermal power generation, process heating and space heating.

(1) Matters Relating to the Labour Force

At the present time, coal miners in the Minto area are organized as Local 7409, sub-district 7 of District 26, United Mine Workers of America. The charter to Local 7409 dates from February 26, 1937. Prior to this date, a number of attempts at union organization had been made but they did not succeed in setting up continuing organizations.

During World War II, the United Mine Workers Union gained rapidly in strength and established itself as the only coal miners' labour organization in New Brunswick. At the end of 1959, Local 7409 had 545 members which represented about 52.7 per cent of the workers employed in the field.

The activities of Local 7409 are governed indirectly by the international constitution of the United Mine Workers of America and directly by the constitution of District 26. Membership in the Union is open to:- "All men and boys working in and about the mines and machine shops and other works .... excepting manager, underground manager, overman, surface foremen and chief engineer, and in shops, master mechanic, foremen and clerks." (Article XIV, Section I.)

Supreme powers for District 26 are vested in a convention of representatives of the district and local unions. Aside from this, authority is delegated to the officers which include a president, vice-president, secretary-treasurer and an executive board of seven members. Between sessions of the District Executive Board, the president has:- "Full power to direct the workings of the district organization." The Executive Board member for each sub-district - Minto is sub-district 7 - is responsible for installing officers in the local unions in his district.

At the local level, there is provision for a president, vice-president, recording secretary, financial secretary, and treasurer. These officers conduct the affairs of the local union.

The local union, according to the constitution of District 26, must appoint a mine committee to inspect the mines of each organized company at least every three months. The committee may be elected every three months, if this is desired, and consists of three workers, two of whom must be working miners.

Each local union may appoint also a wage scale committee, composed of two members from the local: to act with the executive officers of the district in negotiating wage contracts. Separate labour agreements are signed with each company, but the general pattern tends to vary only slightly from one company to the other. The standard agreement includes provision covering the hours of labour, the procedure during a suspension of mining operations or an indefinite shutdown, a schedule of payroll rates for both underground and surface employees, vacations and holidays, grievances, and the duration and termination of the existing agreement.

The Commission has been greatly impressed by the spirit of co-operation and mutual respect which prevails at the present time between union leaders, the rank and file of union membership, and employers and their representatives. The last strike was in 1947 and there has not been even a wildcat stoppage since that time. Both labour and management are to be complimented on the intelligent way in which industrial relations are conducted. The Commission believes that the present excellent situation will prevail in the future.

At the public hearings, representatives of the United Mine Workers of America appeared before the Commission and presented a number of subjects

for study and consideration. The following comments can be made on these matters:-

(a) Coal operators should undertake the reconversion of all worked-out areas.

This matter has been dealt with in detail in Chapter II above.

(b) Coal miners should not be required to work on Sundays or on a seven-day week basis.

The Weekly Rest Period Act, Chapter 16, Revised Statutes of New Brunswick, 1954, requires all employers to give workers twenty-four hours off, each week. The act implies that this day should be Sunday, if it is at all possible. This legislation is enforced by the New Brunswick Department of Labour and the complaint of the Union has been brought to the attention of the Department.

Upon enquiry, the Commission learned that some employers in stripping operations had required some employees to work seven days a week. As has been shown above, this is clearly illegal. As far as the Commission could ascertain, no workers are being required to work seven days a week at the present time.

(c) Shaft operators should undertake a program of mechanization and coal preparation.

The mechanization of shaft mining operations constitutes the principal recommendation of this Commission and is dealt with in detail in Chapter III of this Report.

(d) The Union suggested that the present method of "shooting" coal is harmful to the worker and that the Commission should investigate the

possibility of adopting alternative methods.

The mechanization of shaft mining operations will greatly improve working conditions in the Minto area and should largely eliminate the "shooting" of coal.

(e) Shaft operators should establish a central washing plant for shaft coal.

In Chapter III, the matter of coal washing is dealt with.

(f) The New Brunswick Electric Power Commission should delete its penalty clauses from its purchasing system until a program of mechanization has been commenced.

The penalty clauses are a reasonable method by which the New Brunswick Electric Power Commission protects itself from receiving coal of inferior quality. Coal producers who attempt to produce a high quality product should be compensated.

(g) Consideration should be given to the expansion of coal markets in New England especially in the State of Maine.

This matter is dealt with in Chapter IV which deals with markets and potential markets.

(h) Government purchases of fuel should always include preferential treatment for the New Brunswick Coal Industry.

This matter is dealt with in detail in Chapter IV.

(i) Any stripping practise should be avoided which prevents further recovery of coal, that is, practises whereby stripping cuts are allowed to fill with water.

In Chapter II, the Commission recommends that the Department of Lands and Mines work with coal operators towards an efficient system of consolidating leases and licenses. This should reduce waste in coal recovery. As has been indicated in Chapter II, the cost of filling in stripping cuts cannot be justified at the present time. It is essential, however, that hazards be eliminated to the greatest possible extent.

(j) Wage rates should be increased so as to ensure the future availability of labour.

Wage rates in the Minto area have been increased recently. Given the excellent state of industrial relations in the Minto field, the Commission does not feel that it is required to deal with this matter. Under normal circumstances, the Commission believes that the level of wages is best left to the orderly processes of collection bargaining without the intrusion of third parties.

(k) Coal operators should provide adequate ventilation in shaft mines at all times.

The Commission is satisfied that coal operators are making a real effort to improve ventilation in shaft mines. The problem is rooted, however, in the present method of mining. The mechanization of shaft operations should completely solve the problem of ventilation.

(l) Coal operators should provide adequate wash house facilities for their employees.

Generally, there is great room for improvement in the wash houses provided for employees at shaft mines. In addition, wash houses should be provided at both washing plants. The Commission has been informed that officials

of the Mines Department are making every effort to have the regulations observed. The Commission believes that a definite date should be set by which time all operators should be required to provide adequate facilities.

The Need for an Ambulance in the Minto Area:

At present, an ambulance is not available in the Minto area. Injured miners are taken to hospital in any form of conveyance that happens to be at hand. This is a most undesirable situation. Officials of Local 7409 have informed the Commission that the Union is prepared to make a generous contribution towards the provision of an ambulance for the Minto Hospital. In view of the attitude of the Union, the Commission recommend that every consideration be given by other groups in the area to the provision of funds for an ambulance service.

(2) The New Brunswick Coal Producers Association

The first meeting of the New Brunswick Coal Producers Association was held on November 25, 1935. The original membership of the Association consisted of eight companies:- W. B. Evans Limited, the Minto Coal Company, the Avon Coal Company, Welton Henderson Limited, G. H. King and Company, Harry Welton Limited, Miramichi Lumber Company Limited, and McDougal Brothers.

The aims and purposes of the New Brunswick Coal Producers Association, as set forth in its constitution, are:- "To forward the interests of the New Brunswick coal mining industry and particularly to promote the orderly and efficient distribution of New Brunswick coal at a fair market price." A fair market price is defined as one that permits the employment of labour at a reasonable wage rate and offers a return on capital commensurate with the risks inherent in the industry. The constitution recognizes that, in achieving its aims, the Association should in no way pursue policies which would place undue restrictions upon trade or be contrary to the public interest.

Any individual proprietorship or corporation producing coal in the province of New Brunswick is eligible for admission to the Association. Membership, however, is dependent upon a unanimous vote of approval by the members. In 1944, a qualification was introduced that an operator must be producing annually a minimum of 18,000 tons of coal. This has since been rescinded.

The officers of the Association consist of a President, Vice-President, and Secretary-Treasurer. Together with four additional elected members, these officers constitute the Executive Committee, which, subject to the

direction of the entire membership, has:- "Full authority to do all things necessary or advisable to carry out the purpose and objects of the Association." A motion or resolution of the Association must be approved unanimously before it can become binding upon any member.

The expenses of the Association are paid by a pro rata assessment of all members. The amount to be paid by a member in any one year is calculated on the basis of the year's output as given by the Department of Lands and Mines. The assessment, under the constitution, cannot exceed one cent per ton.

At preeent, there are eight official members of the New Brunswick Coal Producers Association: the Avon Coal Company Limited, D. W. and R. A. Mills, A. W. Wasson Coal Company, Miramichi Lumber Company Limited, King Mining Company Limited, Newcastle Coal Company, V. C. McMann, and Lafferty Brothers. The President of the Association is Mr. Percival Streeter who also represents New Brunswick on the Dominion Coal Board.

The New Brunswick Coal Producers Association presented a formal brief to this Commission. The matters contained in these briefs and the comments and recommendations of the Commission will be outlined below.

<u>The Brief of the New Brunswick Coal Producers Association</u>:

This brief made two basic submissions:- (1) "That the Commission should make a thorough investigation into the future economic outlook of the Minto-Chipman coal fields," and (2) "That an appeal be made to the Federal Government that a subvention on coal be paid to all heavy industry in the Province who make industrial steam. The amount of subvention paid would be governed by the competitive price of foreign residual oils and could be worked out along the same lines as that now paid to the raisers of industrial steam in the manufacture of electric power."

As regards (1) above, an attempt has been made, elsewhere in this brief, to deal in detail with the possibilities and the problems which confront the industry during the next decade. In regard to (2), the Commission believes that mechanization of shaft mines holds out a distinct possibility of Minto coal retaining all its present markets and, indeed, being able to expand them despite the vigorous competition from residual oil.

A considerable period of time will elapse before mechanization could become general in the area. Meanwhile, the shaft mines could be confronted with loss of markets which would be difficult to regain. If such a situation should arise the Commission recommends that a representation be made to the Federal Government for a special subvention. This subvention would be identical with that presently payable on coal used for electric power generation, and would be instituted as an interim measure on New Brunswick shaft-mined coal.

In addition to the brief from the New Brunswick Coal Producers Association, three coal operators:- D. W. and R. A. Mills Limited, the Avon Coal Company Limited, and V. C. McMann Limited presented submissions to the Commission.

The Mills Company proposed that the Federal and Provincial Governments extend financial assistance to them for the purchase of a 34 cubic yard dragline at an estimated cost of two million dollars. The Commission believes that the matter of financial assistance to a particular firm lies outside its terms of reference and is properly a subject for negotiation between the company concerned and the relevant agencies of the Federal and Provincial Governments.

It would appear to be unwise, however, to make major additions to stripping capacity before the possibilities of underground mechanization are fully explored.

The Avon Coal Company Limited made the following recommendations to the Commission:-

(a) That coal operators should be given an exemption from provincial sales tax payable on wire rope and explosives.

Under the Provincial Sales Tax Act, no sales tax is payable on "machines and apparatus" used in the production of goods for sale. Taxes are payable, however, on "consumables" used in production. Thus, wire rope and explosives are taxable under the general application of the Act and their exemption would involve a major change in the Act itself. Any recommendation of this nature would lie outside the Commission's terms of reference.

(b) That coal operators should receive the industrial grant from the New Brunswick Electric Power Commission for the period December 1, 1957 to December 1, 1958.

The Commission discussed this recommendation with officials of the New Brunswick Electric Power Commission. The Power Commission retained the first year's proceeds of the federal subvention on coal used in thermal power generation so as to establish a fund which is used to stabilize the monthly payments to industrial power users. It is not intended that the Power Commission should retain permanently any portion of the funds received.

(c) That the New Brunswick Electric Power Commission should reduce the cost of power to coal operators to at least an average of 1.5 cents per kilowatt hour.

The New Brunswick Electric Power Commission informed this Commission that its power rates to industrial users are based on two determinants:- (1) the total number of kilowatt hours consumed (2) the load factor which results from the demand of the consumer.

V. C. McMann Limited presented the following submission to the Commission:- "That one of the Commission's recommendations be that assistance either from the Provincial Government or the Dominion Coal Board be granted to the New Brunswick Coal Industry for underground mechanization."

In Chapter III, the recommendation is made that a trial mechanization program be carried out as soon as possible.

The Report of the Royal Commission on Coal, published in 1946, summarized the development of Federal subventions on the movement of Canadian coal as follows:-

> Growing out of the attention directed to the Canadian coal supply in the late 1920's and early 1930's, and of the various test movements carried out, and also of the contraction in coal markets in the early 1930's, a system of federal aid to enlarge the markets of Canadian coal developed....... The purpose of these subventions was to equalize the competitive position of Canadian coals with respect to imported coals in various areas, principally Central Canada. The actual methods used varied from year to year, from area to area, and with the nature of the consumer, but in general the Federal Government contributed the approximate difference in laid-down costs of Canadian coal and the imported coal that might otherwise have been used.

The coal subventions are administered by the Dominion Coal Board and they are reviewed, from time to time, as the competitive prices of Canadian and imported coal change in the areas in which the subventions are payable. The sums payable under the subventions are authorized by Order in Council and are paid from funds voted annually by Parliament. Since they were first instituted in 1928, the basic principle of the subventions on the movements of Canadian coal has remained unchanged: to make Canadian coal competitive with imported coal in certain selected areas in Central Canada.

The Present System of Subventions:

The present subventions on the movement of New Brunswick coal were instituted by P. C. 1959 - 508 and remain in force until March 31, 1960. The amounts payable are based on the following regulations:-

(a) to points in Ontario and to points in Quebec and on the Districts of Temiskaming, Pontiac, Gatineau, Papineau and Argenteuil, assistance in an amount equal to seventy per cent of the freight applicable to the shipment or five dollars per net ton whichever is the lesser.

(b) to points in Quebec and in the Districts of Charlevoix, Chicoutimi, Jonquiere-Renogami, Lac-St-Jean, Roberval, Montmorency, Quebec, Portneuf and Laviolette, assistance in an amount equal to forty-five per cent of the freight rate applicable to the shipment; and

(c) to points in Quebec in Districts other than those named above, excluding points east of Levis, assistance in an amount equal to fifty-five per cent of the freight rate applicable to the shipment.

In the above, "District" means the electoral district as plotted on the "Official Map 1956, 20 miles to the inch" issued by the Department of Lands and Forests, Province of Quebec.

Provisions are also made for the payment of subventions on New Brunswick coal transported for use by the railways. These are payable in New Brunswick, Quebec and Ontario and are fixed as follows:-

> An amount equal to the lesser of -
> (a) The difference, as determined by the Board, between the laid-down cost to the railway at those points of New Brunswick coal and of such imported coal as would, in the opinion of the Board, otherwise be used, or
> (b) four dollars per net ton.

Subventions on the movement of Nova Scotia coal cover not only rail shipments but water movements and water and rail shipments to Ontario and Quebec. Indeed, coal transhipped at Quebec ports for a destination in Ontario is apparently eligible to receive a maximum subvention of nine dollars a ton. The subventions on all-rail movements of New Brunswick and

Nova ~~Scotia coal differ in only one respect: New Brunswick~~ coal moving to the Districts of Charlevoix, Chicoutimi, Jonquiere-Renogami, Lac-St-Jean, Roberval, Montmorency, Quebec, Portneuf and Laviolette in the Province of Quebec receive financial assistance to the extent of forty-five per cent of the freight rate. Nova Scotia coal moving to the same areas receives thirty-five per cent. This differential came into being in 1959, when the New Brunswick subventions were amended to bring them into line with the extensive changes made in the Nova Scotia subventions in 1958. The ten per cent differential in favour of New Brunswick reflects the generally lower quality of New Brunswick coal as contrasted with Nova Scotia coal. This difference in quality between New Brunswick and Nova Scotia coal received recognition for the first time in the 1959 subvention regulations. It is in keeping with the general principle of the transportation subventions: to make Canadian coal competitive with imported coal in Central Canada.

<u>Subvention Policy and the New Brunswick Coal Mining Industry</u>:

Until recently, Federal subventions have been of only minor significance to the New Brunswick coal mining industry. Prior to 1957, the largest movement of New Brunswick coal occurred in the fiscal year 1940-41 when 59,353 tons of coal received a subvention of $42,634. In the post-war years from 1945 to 1953, the largest annual shipment under subvention was 3,153 tons. Shipments increased, however, in the next four years and in 1957-1958 and 1958-1959 achieved record levels. In 1957-1958 73,095 tons of New Brunswick coal received subventions of $120,665 and, in 1958-1959, 100,532 tons received subventions of $161,768. Estimates

for the fiscal year 1959-1960, indicate that in excess of 150,000 tons of New Brunswick coal will receive subventions of approximately $290,000. This will be the largest annual volume of New Brunswick coal ever moved under subventions.

The increased sales to Central Canada, in recent years, are due primarily to two factors:- (1) aggressive selling by producers, (2) favourable subvention rates. The bulk of the increased sales has been in the areas in Quebec where subvention rates accurately reflect the difference in the laid-down cost between New Brunswick coal and imported coal.

Over the years, the Federal subvention policy has been of greater assistance to the Nova Scotia coal industry than it has been to the New Brunswick coal industry. In the years from 1928 to 1959, 45,354,073 tons of Nova Scotia coal were moved at a total subvention cost of $85,881,820. In the same period, 615,493 tons of New Brunswick coal received a subvention of $785,566.

Summary:

In recent years, shipments of New Brunswick coal to Central Canadian markets have been increasing and, in 1959-1960, probably approximated 150,000 tons or 15 per cent of total output. This represents the largest annual movement in history of New Brunswick coal under subventions. Favourable subvention rates have been a factor in this development.

Recommendation

As has been indicated in Chapter IV, in the years immediately

ahead, New Brunswick coal will be meeting intensified competition for markets within the province. Thus, it is essential that regulations covering coal shipments to Central Canada be as favourable as possible. The present regulation covering coal movements to certain areas in Quebec reflects the particular qualities of New Brunswick coal as contrasted with imported coal and this provision has been of considerable benefit to the New Brunswick coal mining industry. When changes in subventions are under consideration, the importance of this principle must be recognized.

A P P E N D I C E S

I Report of Franz Tiefengraber

II Report of W. P. Dryer

III Statistical Table

APPENDIX I

DIPL. ING. FRANZ TIEFENGRABER

The Royal Commission on the New Brunswick
Coal Mining Industry,
University of New Brunswick,
Fredericton.

The following report is a statement of the results of an investigation of the coal mining region of Minto. The aim and purpose of this investigation was to analyze and demonstrate, on the basis of the geological conditions of the area, the possibilities of mechanisation and the resultant increase of output and production and greater economy thereof. The individual mines are described and treated separately, in order to give the mine owners an insight into the existent possibilities specifically relative to their company.

Yours truly,

Tiefengraber (sgd).

I

MIRAMICHI COAL COMPANY, Shaft 28.

In general the geological conditions of this plant may be designated as good. The roof consists of a heavy sandstone, which is about 20 ft. thick. The pavement consists of shale, which is not very solid and slightly sandy, but which may nevertheless be well worked. The seam itself has a thickness of about 29 inches, from which a stone band or parting with a thickness of 8 inches is to be deducted. Above the pavement there are 4 inches of coal, then there are 8 inches of stone band parting and above this again 17 inches of coal. (Illustration 1). Complete mechanisation would be somewhat difficult here, since the heavy roof sandstone, in case of an eventual decrease of the seam thickness, would so seriously involve and affect the picks of the drum cutting machine that further operation of this machine would probably be impossible.

Here I would therefore like to propose or suggest a partial mechanisation and, indeed, by means of the S E 11 type of cutting machine. This machine has a height of 12 1/3 inches and can be driven or operated on top of a panzer conveyor. The total height then amounts to 18 2/3 inches. Since the seam thickness, as may be seen from the accompanying profile, amounts to 29 inches, inclusive of the parting, the installation of this machine would be possible without further consideration. Since it is here a question of soft coal shale without admixture of sand, it would -- circumstances permitting -- be possible to cut this out. This is, however, a matter of experience. If this method were not successfully applicable, because perhaps

the picks would thereby suffer too much, then one would have to cut directly above the parting, because experience has shown that sulphur deposits are practically never found there. The cutting direction would have to run from the air level towards the drive of the panzer conveyor. After the cutting the drive must again be made with recoiling chain to the starting-point, that is to the air level. In this way the cuttings or 'gum', no matter whether it is a question of coal or parting, will be conveyed away. This panzer conveyor type of E B 440, supplied by the Eickhoff Firm, has a small height (6 1/3 inches) and breadth (17 2/3 inches) and nevertheless a conveying capacity of 75 tons per hour. Accordingly it would be generally suited to the conditions in Minto. Its motor capacity amounts to 16 H.P. This can moreover be doubled by the installation of 2 power units or engines. I would recommend this for a length of 300 ft.

On the basis of experience the following rhythym of work in the cutting of coal has up to date proven to be good:
The faces are cut at night, whereby this is to be arranged from the time standpoint, so that the cutting and the loading of the cuttings or 'gum' is finished shortly before the morning shift. This is important in order to keep the time between cutting, mining and timbering as short as possible, so that very little time is allowed for the roof to start to move. The morning shift which follows the cutting loads the 4 ft. cut field away and advances the roof bars. Generally it may be calculated that, since the cuttings were already removed or put away during the night, every coal miner must cover a

distance of 30 to 33 ft. in the cut coal. At the end of the coal loading shift the panzer is moved by the 10 coal miners to the mine field. Since no compressed air is available, this must be done by hand-jacks. The steel prop drawers, who follow the coal shift, consist of 6 men to every face. It is understandable that during the period of familiarization and co-ordination of the new method a few more men must be on hand, since the crew must first be accustomed to and trained in the new conditions. These steel prop drawers must now place the props already at hand under the roof bars advanced by the coal miners and withdraw the last row of roof bars and steel props. Moreover, still two more men are necessary to take out 9 - 12 ft. of solid coal and top brushing in order to make room for the next run-cut. A statement of the conveyance and necessary employees for both shifts is contained in the following diagram:

The daily conveyance of coal from both faces (each 300 ft. in length) with a cutting depth of 4 ft. amounts in tons as follows:

$$\frac{2 \times 300 \text{ ft.} \times 4 \text{ ft.} \times 1.75 \text{ ft.}}{25} = \underline{\underline{168 \text{ tons per day}}}$$

1). Shifts required in the faces.

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Coal miners	18			18	
Face boss	2			2	
Prop drawers		12		12	
Cutters			4	4	Begin ca. 3 a.m.
Roof brushers		2		2	
TOTAL	20	14	4	[illegible]	

FACE OUTPUT: 168 tons ÷ 38 = 4.42 tons per shift.

2). Other Shifts in the mine.

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Belt service	5				
Development	7				6 tons of coal daily
Foremen	2				
TOTAL	14				

MINE OUTPUT: 174 tons ÷ 52 = 3.35 tons per shift.

3). Surface Shifts.

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Hoisting engineers	1	1		2	Machine repair during afternoon
Bottom men	1	1		2	Saw & prepare wood during afternoon
Other shift men	3			3	
TOTAL	[illegible]	2		7	

TOTAL OUTPUT: 174 ÷ 59 = 2.95 tons per shift.

If we take as a basis a present average total output of 1.60 tons per shift in the Minto coal mining region (calculated with reference to the mines without open-pit mining), then this type of mechanisation signifies an increase in output of about 84%. To this may be added the timbering costs saved by the installation of steel props and steel roof bars, which are by no means inconsiderable (they range between $20,000 and $35,000 dollars per annum). In addition to this there is the higher safety of the employees in the mine. The losses in steel props and bars are about 1% per month.

LAYER SEQUENCE SCALE - 1 : 20

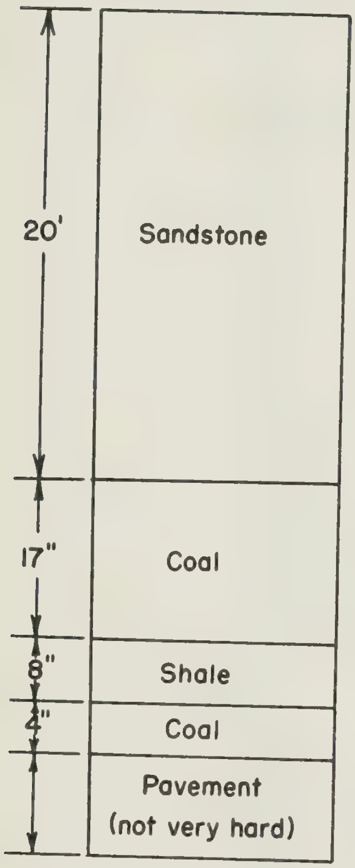
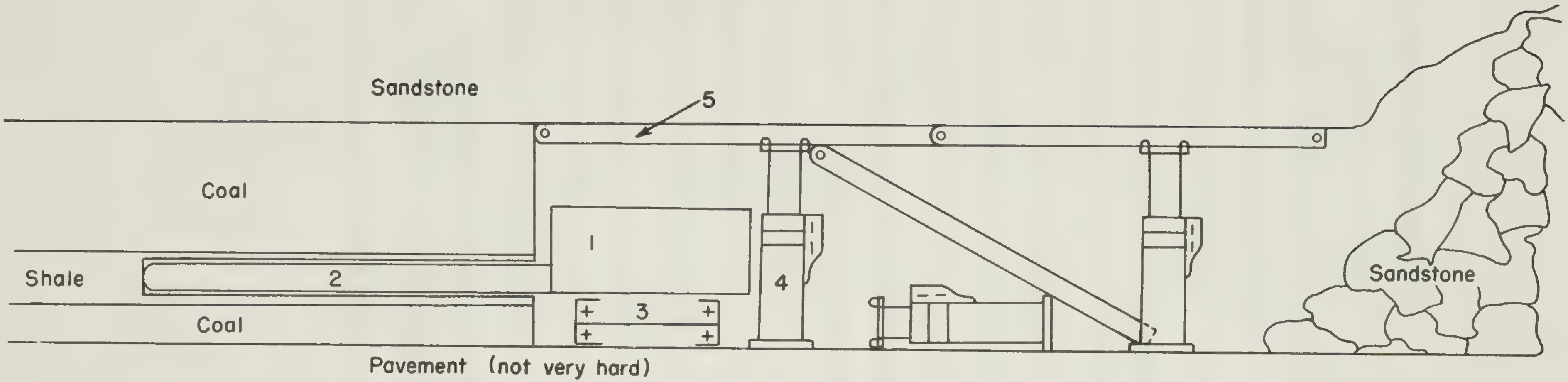


Plate 2



1	Cutting Machine : 63 H.P.	Height : 12 1/3" Width : 26"
2	Jib :	Length : 4'10" Depth of the cut : 4'2"
3	Panzer conveyor	
4	Steel prop	
5	Roof bar	

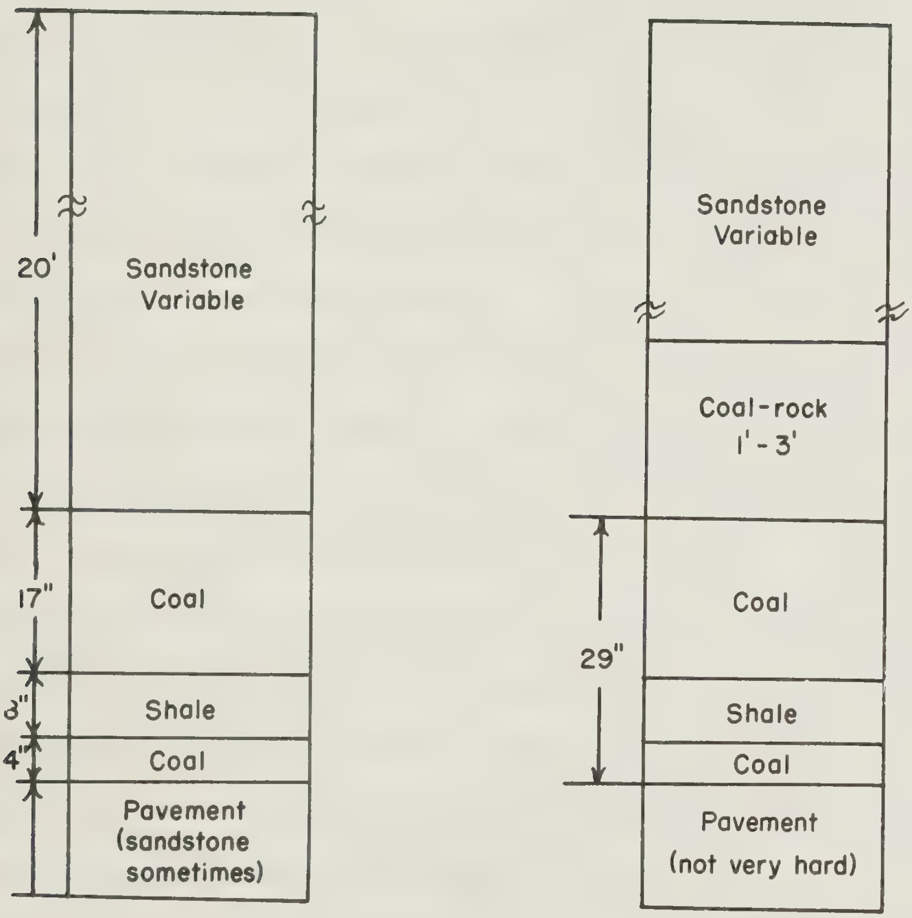
Ia

MIRAMICHI COAL COMPANY, Shaft 27.

I would not at present recommend mechanisation of the mine in shaft 27 of the Miramichi Coal Company, because the geological conditions here are not suitable. The roof consists partly of clay shale, which varies strongly in its thickness (from 0 - 3 ft.). It is very friable and frequently exhibits cracks or fissures which are damp and slippery and extend up to the solid sandstone. As a result the roof is more or less incoherent, so that a probability exists that, directly after the cutting, the roof might settle simultaneously with the coal right up to the sandstone, that is between 0 - 3 ft. A regulated rhythm of work would therefore not be assured or guaranteed. In other parts of the mine, predominantly in the proximity of the shaft, this clay shale is completely lacking. Here the sandstone bank in a thickness of about 20 ft. directly forms the roof over the coal. These parts are, however, not very extensive. Moreover, there are cracks and fissures in the sandstone, which let the surface waters through, so that the clay shale above the coal becomes slippery and the holding of the roof becomes even more difficult.

If, however, the rock conditions were to change favorably (after the completion of the new shaft perhaps), then mechanisation could still be taken under consideration at a later date.

LAYER SEQUENCE MIRAMICHI COAL CO.
SHAFT 27 SCALE - 1:20



II

VICTOR McMANN COAL COMPANY.

The geological conditions in Mr. McMann's mine are in every respect essentially better than those of the Miramichi Coal Company. The roof consists of level layers of coal rock in different thicknesses, very suitable for caving system and long wall faces or roof brushing in levels. The thickness of this clay shale amounts to about 20 to 30 ft. Above this there lies a sandstone bank of about 8 ft. thickness. Directly beneath the roof shale runs a coal strip about 1/3 inch thick and beneath that a parting of soft coal rock about 4 inches thick, which -- it is to be assumed -- would scarcely affect or detract from the extraction of coal by means of the drum cutting machine. Under no circumstances should this parting be retained while the coal is being worked and extracted, for immediately after the mining of the field with the coal strip, it would loosen itself from the main roof. The coal seam beneath this parting has a thickness on the average of 22 inches of pure coal; beneath this is located a 2 inch thick strip of impure coal. The pavement is a 6 inch thick stratum of medium solid, well-workable sandy shale, which one could take along without further trouble when driving the levels. Beneath this is solid sandstone. According to the foreman's report the pyrite deposits occur mainly in the upper third part of the seam, but are, however, not all too frequent. They are egg- or sphere-shaped; they can, however, also be oblong or elongated. Then they mostly have a thickness of about one inch and a length of five to six inches. They can be reached and picked up by the picks when cutting with the drum

cutting machine, since there is a horizontal distance of about 3 - 4 inches between the picks which are mounted on the drum. If this machine could now be remodelled and rebuilt for the Minto seam conditions, then an attempt could be started. I must, however, draw attention to the fact that in the case of frequent appearances of pyrite deposits the cutting picks can be severely affected. Here alone experience through experiment must speak the last word. The most suitable type of machine would be S W 670 with a motor capacity of 16 KW (20 H.P.) and an operating speed of 450 - 900 ft. per hour, according to the hardness of the coal.

In the case of an average speed of 650 ft. per hour and a cutting depth of 8 inches in a face of 300 ft. in length, 12 cuts must be made in order to mine a width of 8 ft. At this medium speed accordingly the pure cutting time would amount to 5.5 hours. The conveyance from both faces would amount as follows:

$$\frac{2 \times 300 \text{ ft.} \times 8 \text{ ft.} \times 2 \text{ ft.}}{25} = \underline{\underline{380 \text{ tons per shift}}}$$

Shifts required in the face.

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Cutters	4				
Steel prop drawers	24				Begin one hour earlier.
Timber Boss	2				" "
TOTAL	30				

FACE OUTPUT: 380 tons ÷ 30 = 12.7 tons per shift.

Other Mine.

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Development	7	7		14	12 tons of coal
Belt Service	5	2		7	
Roof Brushing		4		4	
Foreman	1	1		2	
TOTAL	13	14		27	

MINE OUTPUT: 392 tons ÷ 57 = 6.87 tons per shift.

Surface:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Hoisters	1	1		2	Afternoons may be occupied with other work.
Bottom men	1	1		2	
Other shift workers	2			2	
TOTAL	4	2		6	

TOTAL OUTPUT: 392 tons ÷ 63 = 6.22 tons per shift.

This would represent an increase in output of 288%. This would, however, always depend upon the assumption that the pyrite deposits occasion no essential difficulties and that the machine may be rebuilt for local conditions prevailing here.

If this, however, should not be the case, then in any case a cutting machine of the type S E 11 could be installed. That would result in the following yield or picture:

Conveyance in tons in the case of a daily advancement of a field in a depth of 4 ft. in two faces each 300 ft. in length:

$$\frac{2 \times 300 \text{ ft.} \times 4 \text{ ft.} \times 2 \text{ ft.}}{25} = 192 \text{ tons per day.}$$

Shifts required in the face:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Cutters			2	2	
Coal miners	20			20	
Face Boss	2			2	
Steel Prop drawers		12		12	
TOTAL	22	12	2	36	

FACE OUTPUT: 192 tons ÷ 36 = 5.33 tons per shift.

Other Mine:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Development	7			7	6 tons of coal
[illegible]	5			5	
[illegible]		2		2	
Foreman	1	1		2	
TOTAL	13	3		16	

MINE OUTPUT: 198 tons ÷ 52 = 3.8 tons per shift.

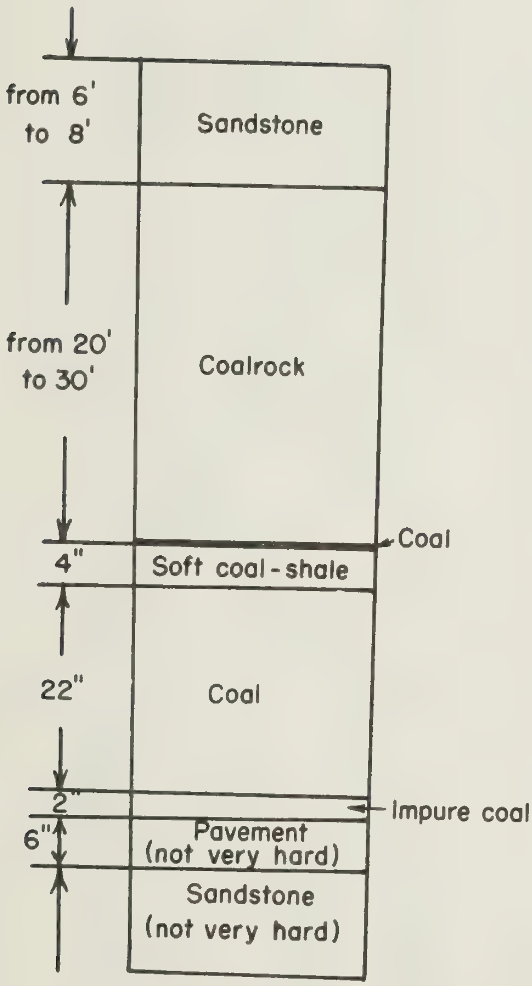
Surface:

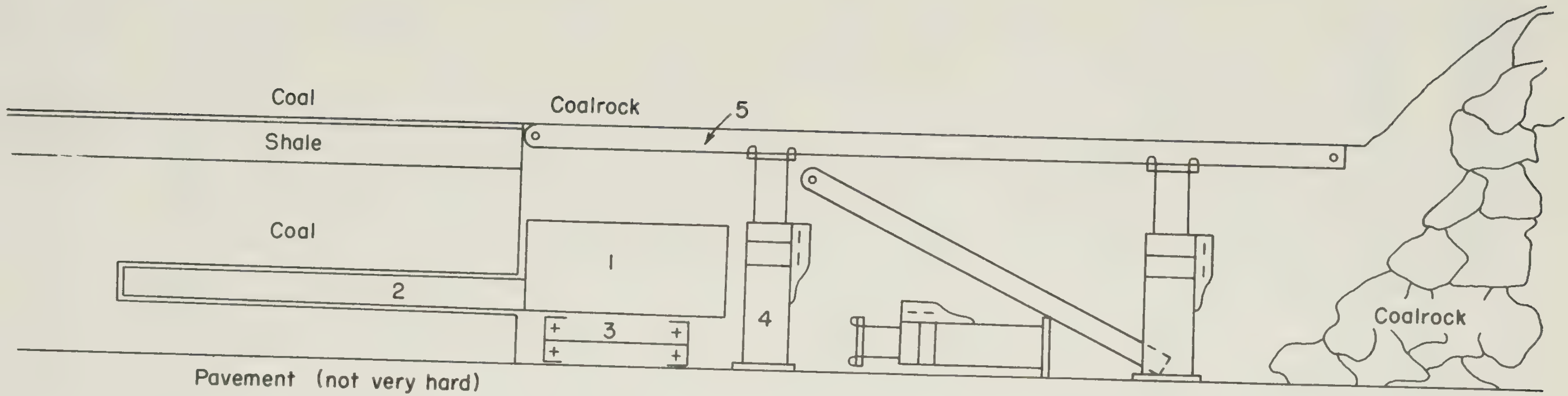
Activity	[illegible]-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Bottom men	1	1		2	Can attend to repairs and timber preparation during afternoons
[illegible]	1	1		2	
Other shift workers	2			2	
TOTAL	4	2		6	

TOTAL OUTPUT: 198 tons ÷ 58 = [illegible] per shift.

This therefore would still signify an increase in output of 1.8 tons per shift or 112%. In addition to this there is the saving of mine timber through the use of steel props and steel roof bars and the resultant higher safety of the face crews. It must still be added that the parting cannot, of course, be extracted by cutting, because it lies directly beneath the main roof. Thus, no matter which type of mechanisation is adopted, a washing of coal cannot be eliminated.

LAYER PROFILE





1	Cutting Machine	: Typ SE II
2	Jib :	Depth of the cut : 4'2"
3	Panzer conveyor	: Typ EB 440
4	Steel prop	: Typ TCR
5	Roof bar	: Typ TZG 70 Length : 4'2"

III

WASSON COAL COMPANY

Here the geological conditions are thoroughly suited to mechanisation and long wall faces with caving system and steel prop free working wall. The roof of the seam consists of clay shale of 8 to 12 feet in thickness. Above this lies sandstone. The pavement is of fairly solid sandstone. The seam itself has a total thickness of an average 27 to 28 inches, of which, however, only 21 to 22 inches is pure coal. A parting in the upper third part of the seam, consisting of soft, marly shale in a thickness of 6 inches, divides this into two parts. Above the parting lie 5 inches of coal and below it about 16 to 17 inches. The pyrite deposits are usually to be found just below the parting. Here a suggestion was made -- which in my opinion could also be realized -- that with the help of a cutting machine of the type S E 11 the 6 inches thickness of parting could first be cut out. Generally the 5 inch thick strip of coal falls away of itself after this. Wherever this is not the case, a man with a pick hammer must loosen the coal after the cutting machine. Thereupon the roof bars must be advanced immediately by two men. Only when this has been done, should the pavement coal be extracted with the help of a drum cutting machine, provided that the latter can be remodelled and rebuilt for the coal mining region in Minto. At the very most the height should be 520 to 530 mm, that is, therefore, about 21 inches and this refers to the panzer conveyor and the drum cutting machine mounted or driven upon it. Since the panzer conveyor has a height of 6 1/3 inches, the machine should have at the very most 15 inches.

Whether this is attainable will be stated in the reply from the Eickhoff machine factory, to whom I have directed this fundamental question. The drum diameter should here be about 21 inches and be geared so that it takes the coal along with it to the pavement. If this is not feasible or practicable, then the drum should at best have a diameter of about 14 inches; that means that the roof bars can be advanced only after the cutting with the drum machine. This type of extraction would have the following advantages:

1) Circumstances permitting, a washing could be eliminated or dropped.

2) The output would be considerably higher than in the case of the cutting work with a machine of the type S E 11, since less people are used. The following diagram gives a closer and more detailed observation of the conveyor amounts in tons per day and the shift personnel necessary for this:

2 faces each of 300 feet, thickness of coal: 21 inches, depth of the field 4 ft.

$$\frac{2 \times 300 \text{ ft.} \times 4 \text{ ft.} \times 1.75 \text{ ft.}}{25} = \underline{\underline{168 \text{ tons per day.}}}$$

Shifts required in the faces:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Cutters	4			4	
Roof Brushers	4			4	Begin 3 hrs. later
Prop drawers	4	12		16	Begin 4 hrs. later in the morning
TOTAL	12	12		24	

FACE OUTPUT: 168 tons ÷ 24 = 7.00 tons per shift.

Other Mine:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Development	7			7	6 tons of coal
Belt service	5			5	
Roof Brushers	2			2	
Foreman	1	1		2	
TOTAL	15	1		16	

MINE OUTPUT: 174 tons ÷ 40 = 4.35 tons per shift.

Surface:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Bottom men	1	1		2	During the afternoon repairs and preparation of timber.
Hoisters	1	1		2	
Other shift men	2			2	
TOTAL	4	2		6	

TOTAL OUTPUT: 174 tons ÷ 46 = 3.78 tons per shift.

If no washing facilities are available, then two additional men would be needed for the picking belt, so that the total output would thus be altered:

174 tons ÷ 48 = 3.62 tons per shift.

With the use of a cutting machine of type S E 11 approximately the following output would be obtained:

Shifts required in the face:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Cutters			4	4	Begin 3 hrs. earlier (3 a.m.)
Coal miners	20			20	
Face Boss	2			2	
Prop drawers		12		12	
TOTAL	22	12	4	38	

FACE OUTPUT: 168 tons ÷ 38 = 4.42 tons.

Other Mine:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Development	7			7	6 tons of coal
Belt service	5			5	
Roof brushers	2			2	
Foreman	1	1		2	
TOTAL	15	1		16	

MINE OUTPUT: 174 tons ÷ 54 = 3.22 tons per shift.

Surface:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Bottom men	1	1		2	Repairs and preparation of timber during the afternoon.
Hoisters	1	1		2	
Other shift men	2			2	
TOTAL	4	2		6	

TOTAL OUTPUT: 174 tons ÷ 60 = 2.90 tons per shift.

If no washing plant is available, then two additional men would be needed for the picking belt. The total output would then be:

174 tons ÷ 62 = 2.80 tons per shift.

It is conceivable that mechanisation with a drum cutting machine in combination with a cutting machine of type S E 11 is a more ideal method of extracting the coal. But, when this type is not feasible or practicable owing to technical difficulties, then working with the S E 11 without drum cutting machine would still mean a noteworthy increase in output, which would be 100% higher than is at present the case. I would furthermore like to note that the hypothetical data concerning shift personnel and conveyance are cautiously calculated. It also goes without saying that, before these figures are reached, a preliminary period of about two to three months with some additional employees is necessary, because every man must first be initiated and trained in his place therein.

LAYER SEQUENCE

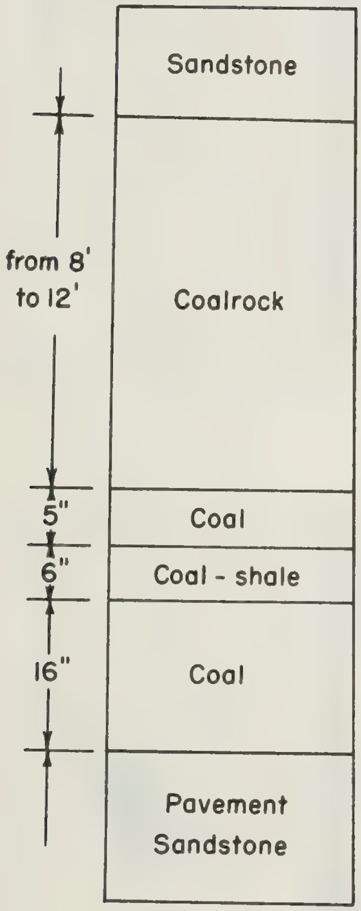
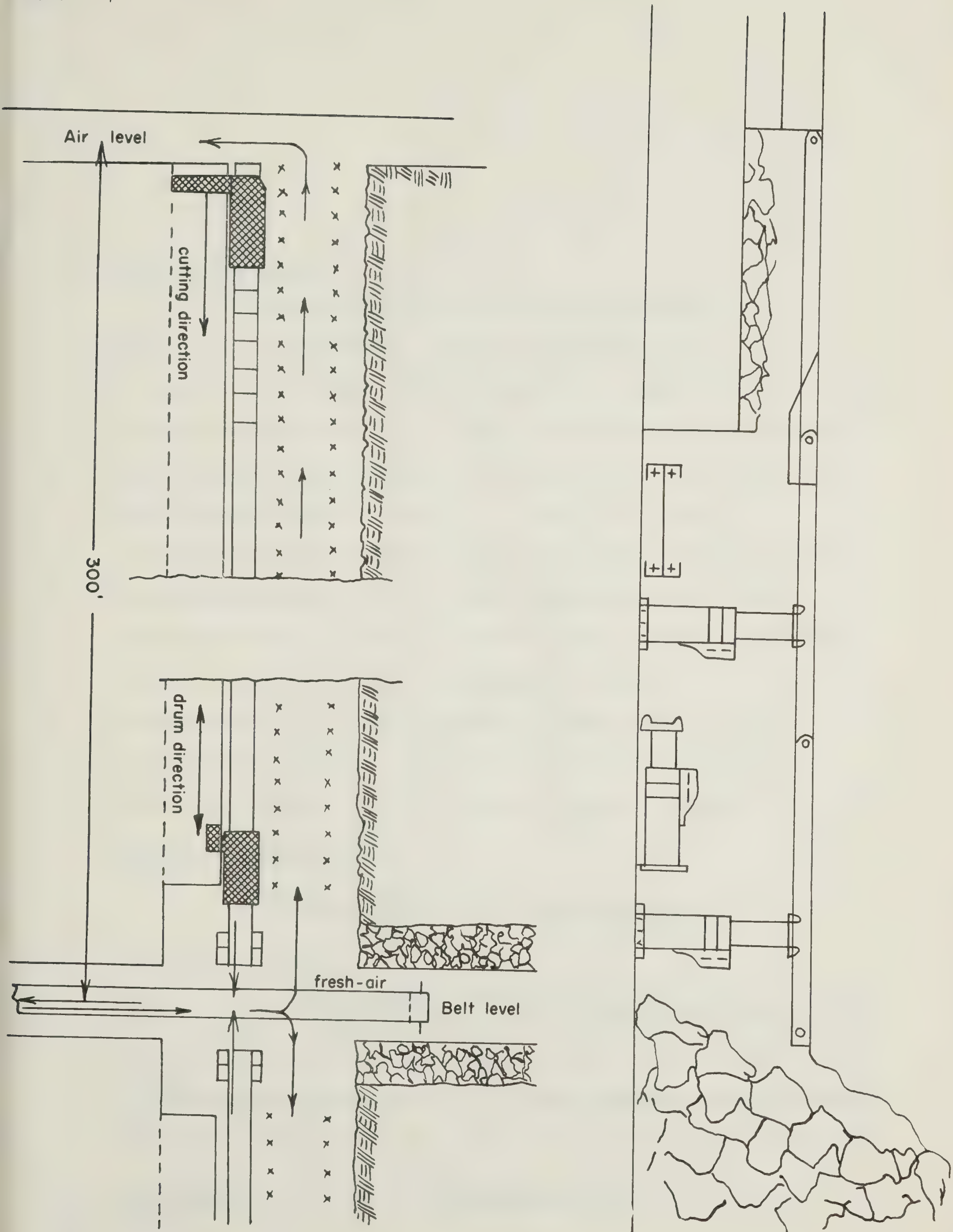


Plate 7


Air level
cutting direction
300'
drum direction
fresh-air
Belt level

IV

NEWCASTLE COAL COMPANY

The geological conditions in this mine are very similar to those in that of Mr. McMann. Directly above the coal lies a soft parting of about 3 inches. Above this lie level layers of coal rock in different thickness from 6 to 8 feet. And above this lies sandstone. The seam itself is altogether about 21 inches, of which the first 3 inches directly above the pavement are impure coal. There is absolutely nothing to interfere with mechanisation of the plant from the geological as well as the technical mining standpoint. With a drum cutting machine, which must first be rebuilt for Minto conditions, one could obtain the following conveyance and output:

Two faces each 300 ft. long are worked. In each face 8 ft. of coal will be cleaned out daily. The front of the face is steel prop free. Cutting and timbering are done in one shift (morning shift).

Conveyance in tons each day:

$$\frac{2 \times 300 \text{ ft.} \times 8 \text{ ft.} \times 1.75}{25} = \underline{\underline{336 \text{ tons per day}}}$$

Shift men in the face:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Cutters	4			4	
Prop drawers	24			24	
TOTAL	28			28	

FACE OUTPUT: 336 tons ÷ 28 = 12 tons per shift.

Other Mine:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Development	7	7		14	12 tons of coal
Belt service	5	3		8	
Roof brushers	4			4	
Foreman	1	1		2	
TOTAL	17	11		28	

MINE OUTPUT: 348 tons ÷ 56 = 6.21 tons per shift.

Surface:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Hoisters	1	1		2	Can attend to other additional work during afternoon.
Bottom men	1	1		2	
Other shift men	2			2	
TOTAL	4	2		6	

TOTAL OUTPUT: 348 tons ÷ 62 = 5.61 tons per shift.

It must be emphasized that these figures absolutely do not represent the peak output, since they were only calculated with an operating speed of the drum cutting machine of 650 ft. per hour (thus not even with half the attainable speed) and the lowest or least cutting depth of 8 inches. The machine reaches a speed of 400 ft. per hour to 900 ft. per hour. According to the hardness of the coal (experience values) the cutting depth can amount to 8 to 30 inches in a cut. Circumstances permitting, it would thus be possible to increase or raise the speed as well as the cutting depth higher than is here assumed. This cannot yet, however, be established in figures. For this reason the calculations were made very cautiously in all cases.

With the use of the cutting machine of the type S E 11 the following results would be yielded under the same conditions with reference to the face lengths (2 300 ft.):

Daily conveyance in tons in the advancement of a field 4 ft. in width:

$$\frac{2 \text{ x } 300 \text{ ft. x } 4 \text{ ft. x } 1.\text{[illegible]}}{25} = \underline{\underline{168 \text{ tons per day.}}}$$

<u>Shift men in the face:</u>

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Coal miners	20			20	
Face boss	2			2	
Prop drawers		12		12	
Cutters			4	4	Begin at about 3 a. m.
TOTAL	22	12	4	38	

<u>FACE OUTPUT</u>: 168 tons ÷ 38 = <u>4.42 tons per shift</u>.

Other Mine:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Development	7			7	6 tons of coal
Belt service	5			5	
Roof brushers	2			2	
Foreman	1	1		2	
TOTAL	15	1		16	

Below-Surface OUTPUT: 174 tons ÷ [illegible] = 3.22 tons per shift.

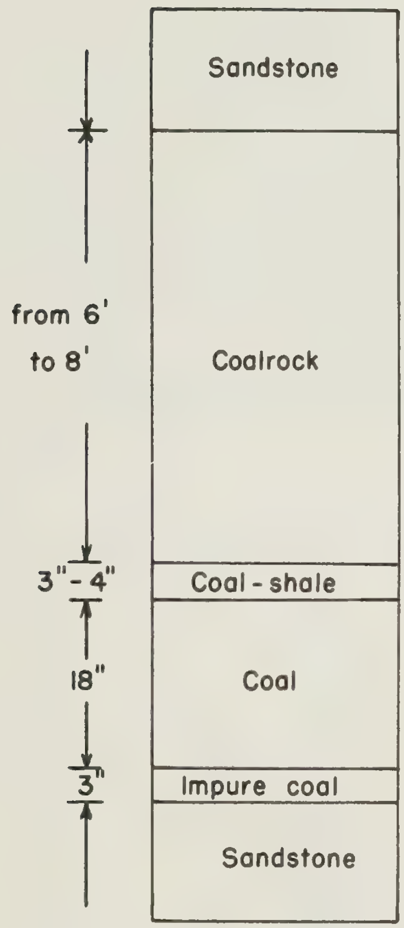
Surface:

Activity	7-15 Mornings	15-23 Afternoons	23-7 Nights	Total	Observations
Hoisters	1	1		2	
Bottom men	1			1	
Other shift men	2			2	
TOTAL	4	1		5	

TOTAL OUTPUT: 174 tons ÷ 59 = 2.95 tons per shift.

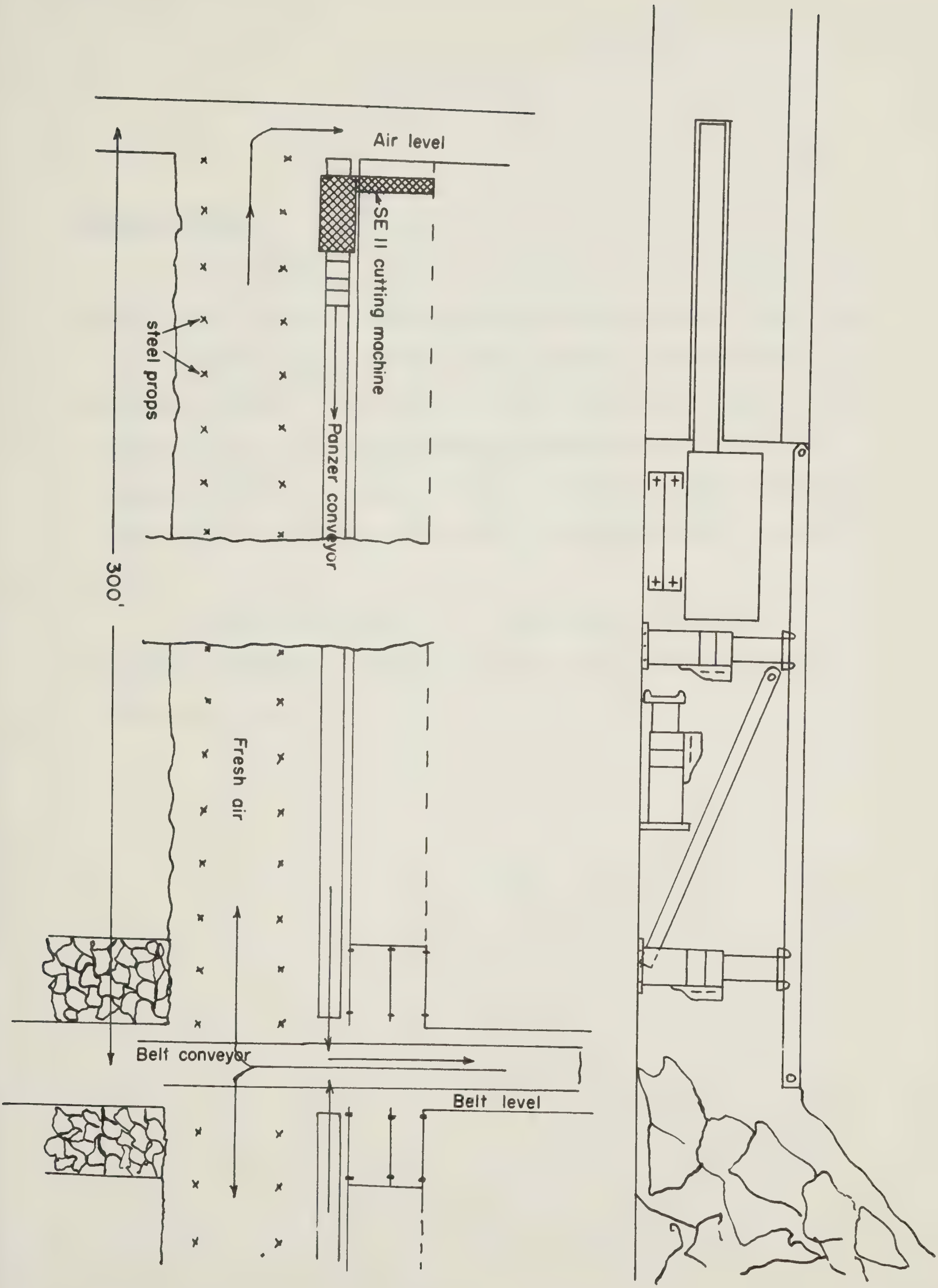
These output figures can, to be sure, only be attained in connection and combination with the rest of the project, which is attached to this report and which I have discussed with Mr. McMann, Mr. Tooke, Mr. Flower and Mr. Nichols. These outputs can certainly not be attained if the conveyor boxes presently used are retained, because the haulage of the coal would be too slow and the resultant stops in the face would be too long to permit a regulated rhythym of work. Moreover, some additional employees would have to be added and distributed in the mine as well as on the surface. It is to be assumed that with these wage costs the conveyor belts in the levels would be paid.

LAYER PROFILE SCALE - 1:20



As may be seen from the face view, the 3 inch thick parting above the coal cannot be cut, since the machine height would be too great. This is a considerable disadvantage, for as a result of this two or three more men must be engaged for the picking out of the rock, something which has an effect on the total output. It is to be assumed that the latter sinks from 2.95 tons per shift to about 2.75 tons per shift. Nevertheless this still signifies an increase in output of about 72%.

Plate 9



Air level
SE II cutting machine
steel props
Panzer conveyor
300'
Fresh air
Belt conveyor
Belt level

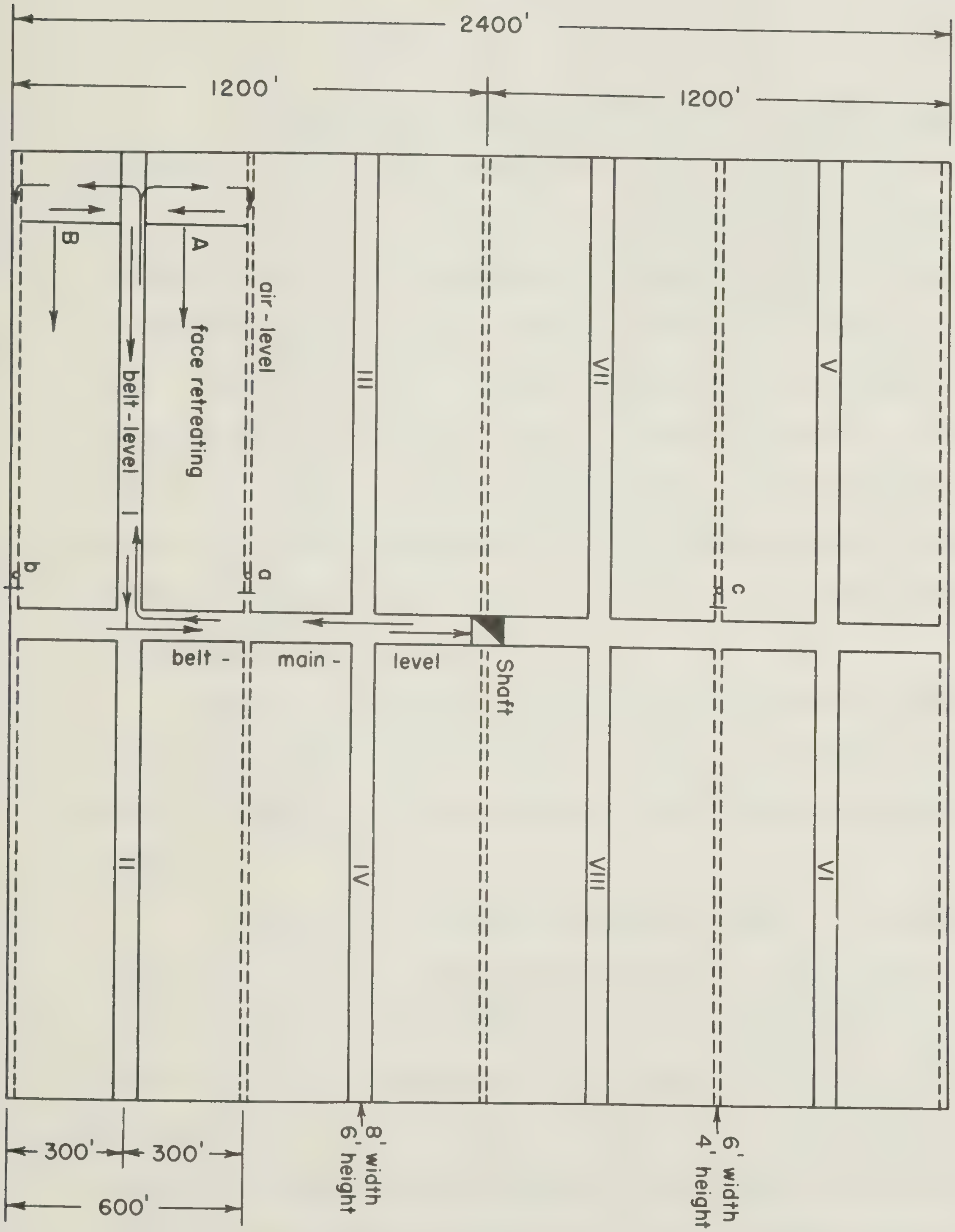
V

GENERAL SURVEY

As a result of a detailed inspection of the five mining plants in the Minto coal region it may be stated in summary that, owing to the generally good geological conditions there, mechanisation is absolutely possible. One exception is Shaft 27 of the Miramichi Coal Company, since in this case the roof is too friable and cracked or fissured and there is a danger that the rock would collapse immediately after cutting. In all the other mines mechanisation could be carried out.

In connection with this I would like to describe and represent schematically the project which I have proposed to all the authoritative gentlemen.

Plate 10


2400'
1200'
1200'
B
A
air - level
face retreating
belt - level
I
II
III
IV
V
VI
VII
VIII
a
b
c
belt - main - level
Shaft
300'
300'
600'
8' width
6' height
6' width
4' height

In the middle of a square of 2400 ft. in lateral length the shaft is sunk; this is usually about 90 ft. deep and made without any great expenditure. As a result of the alight thickness of the seam (there is only one present) and the higher conveyance obtained through mechanisation, the conveyor paths become very long in a short time. Therefore it seems to me that it would be more favorable to sink a new shaft in the square for every field of 2400 ft. Each square contains about 400,000 tons of coal which with the use of cutting machines and a daily advancement of 4 ft. in width and 600 ft. face length is mined in 8 years. This corresponds to an annual haulage or conveyance of about 50,000 tons.

With the use of drum cutting machines, insofar as these could be rebuilt for seam conditions in Minto, this square would be mined in 4 years. The yearly haulage in this case would amount to 100,000 tons.

In the case of a daily advancement of only 4 ft. ahead in 2 faces each 300 ft. in length about 174 tons of coal inclusive of development would be hauled or conveyed, whereby 6 tons thereof may be deducted for development. With adequate forcing of the development two further faces each 300 ft. could be mined in rectangle II and thus the haulage could be doubled. If the development of this square could be begun on August 1, 1959, then the mining scheduled in my project could be begun in January 1962. All levels would have to be manned up to two-thirds. In order to obtain an increase in output already in the meantime, faces of 300 ft. in length could be set up in a short time. The conveyance would, of course, still be

done by conveyor boxes; as a result the final output could still not be reached. This, however, would contribute greatly to the unquestionable success of the final project, since the mine workers could already be trained during the time when the development is being worked out.

At the beginning of the mining within this square the rectangle I and III must be completely set up so that, while mining is going on in I, the rectangle III is being set up. If I and II are simultaneously mined, then the development in III and IV would, of course, run simultaneously. I would recommend that the belt level, in which the belt later runs, be driven into the pavement bottom with 8 ft. (roof or top 7 ft.) in width and 6 ft. in height in order to assure or guarantee (1) an easily controlled belt service and (2) a safe track for the employees. The air levels at the end of the 300 ft. long faces can be driven without hesitation with 6 ft. in the pavement bottom and 4 ft. in height.

The mining of the coal must take place in the retreat, since it is only with this kind of advancement that men may be saved for the holding up of the levels. My calculations are thus all based upon a retreat of the coal, haulage or conveyance to the shaft by means of a transport belt and a skip hoisting in the shaft, whereby the loading and unloading takes place completely automatically. The skip should be able to take or hold about 2 tons. With a conveyor speed of 7 ft. per second a trip in a shaft depth of 90 ft. should last about 13 seconds. If ten seconds are assumed for the emptying of the skip and 20 seconds for its loading, then this results in a total conveyance time of 2 x 13 + 10 + 20 = 56 seconds. Therefore, approximately calculated,

one minute. Accordingly 60 trips with 2 tons aboard can be made hourly. This corresponds to a hoisting amount of 840 tons in 7 hours. The shaft hoisting can thus justify all types or varieties of mechanisation which would be suitable for this region. After the mining of the first half of this square the development of the next would already have to be begun, insofar as drum cutting machines would be used, because the second half would be mined within two years and the development of the new square would last a good year and a half. If, on the other hand, cutting machines of the above-mentioned type are used, then the beginning of the development of the adjoining square may be so long delayed until the mining of the rectangle VII is begun. That is, then, six years after the beginning of the mining in the first square. I have marked the individual rectangles according to the sequence of mining.

Ventilation.

Through the type of mining described above the ventilation is essentially simplified, cheaper and better for the employees. The air enters through the main shaft, passes through the main level and the belt level up to the loading place, where it then separates. The one half passes through face A (cf. schematic illustration) and through the air level down to the drill hole a, which has a diameter of 24 inches. Here the air is sucked out by a ventilator which is situated at the surface. This drill hole is suitably devised as a second exit. The second half of the air passes through face B, through the air level to the drill hole b, and is sucked out by a ventilator

which is likewise situated at the surface. This drill hole b has a diameter of 12 inches. The drill holes are 20 ft. distant from the main level and separated from the latter by air-tight doors, so that no short circuits at all may arise. The ventilation in the other fields designated with Roman numbers is analogous to that of Field 1. In the second half of the square the drill hole c must serve as a second exit.

The Cleaning of Coal

The coal extracted by the drum cutting machine is naturally so strongly impurified by the dragging along of the parting that cleaning by hand can no longer be done. It is therefore absolutely essential that the coal be washed. Exceptions to this are the Miramichi and Wasson mines, for here in these cases the parting is so situated that it may be taken out with a cutting machine and carried away. Only when this has been done, should the cutting drum be used. In this way it would probably be possible to keep the coal clean to such an extent that a picking out of the rocks by hand is permissible. In both of the other plants (Mr. McMann and Newcastle Coal Company) this method may not be used, because the parting lies directly beneath the main roof and cannot be cut, for the superstructure on the machine body would be too high. Here the coal must be cut. It is thus comprehensible that the last-named mines in the case of mechanical coal extraction -- no matter what type -- must have a coal-washing plant, in order to make a saleable product for the market.

In order not to expect each individual mine owner to bear the high costs of a separate coal washing plant, I would suggest that at least the McMann Coal Company and the Newcastle Coal Company install a joint or shared unit or outfit of this nature; it should be as central as possible and beside the railway. I have in mind a washing plant, in which each of the mines can wash its coal separately from the other and in which nevertheless the service crew is not thereby enlarged. The individual mine owners would have to deal with this problem in a common discussion. I hope that through this outline of all the possibilities of mechanisation and the resultant rationalisation I have been able to make a small contribution to a prosperous growth and development of the Minto coal region. I am pleased that on the basis of these recent investigations the question as to the possibility of an extensive and substantial mechanisation may be answered in the absolutive positive.

In conclusion I would like to express my sincere thanks to all the gentlemen concerned, especially Professor W. Smith as representative of the Royal Coal Commission, for their intense interest and their assistance and support in all matters of importance.

Yours truly,

Frz. Tiefengraber (sgd).

Addenda to Appendix I

Drum Machine

Since his report was submitted, Mr. Tiefengraber has investigated the progress that is being made in the development of the drum machine in West Germany. He states that a machine of the proper size to operate efficiently in the Minto area is now in production and is being submitted to intensive tests before being made available commercially.

The manufacturers state that they expect the machine will be fully developed and available for installation by October, 1960.

Financing Mechanization

The Commission has discussed the possibilities of coal operators receiving financial assistance for underground mechanization with officials of the Dominion Coal Board. They state that loans for this purpose can clearly be made under the Maritime Coal Production Assistance Act.

APPENDIX II

Report on Investigation in the Ruhr, Germany, of Underground Mechanized Methods of Mining Thin Coal Seams.

By

W. P. Dryer, Consulting Engineer.

October, 1959.

On instructions from Prof. W. Y. Smith, Chairman of the Royal Commission on the New Brunswick Coal Mining Industry, I made this investigation in the Ruhr in the first half of September, 1959. The investigation was made so that I could form an opinion of the recommendations made by Mr. Franz Tiefengraber on economical methods of underground mining proposed for the Minto field. His recommendations were based on his two months' study in that field - in June and July, 1959. In all parts of my investigation in the Ruhr I was accompanied by Mr. Tiefengraber.

The following is an account of my investigation.

Part 1.

General description of mechanized shaft mining.

The methods of mining I investigated, and proposed by Franz Tiefengraber for Minto, comprise coal-cutting machines, conveyors, and steel roof props and bars.

First, a steel trough 2 ft. wide is laid along the length of the coal face, which is some hundred feet long. The trough serves as a conveyor for the coal cut by the machine, having a continuous chain with slats pulling coal to the outlet. Along the length of the trough its edges are turned up 3" or 4" and on these edges the coal cutting machine (drum or chain type) rides.

Also along the length of the trough and a few inches above it is a chain fixed at each end of its length. The chain is wound around a sprocket wheel in the coal cutting machine, which on being driven by an electric motor inside it, turns the sprocket and so causes the machine to advance along the face: the motor is simultaneously driving the cutting picks, on drum or chain machines. The coal cutting machine plows or drags the coal into the trough, and it in turn delivers to belt conveyors running to the shaft.

An important feature of the methods I saw on the Ruhr and proposed by Mr. Tiefengraber for Minto, is the steel props and roofbars, which are said to be cheaper than wood.

As proposed for Minto, the coal cutting and conveying would occupy one shift, the other two shifts being taken up with preparing further mining, advancing the trough, props and roof bars into place for another cut along the long face, which in Minto would be 300 feet long.

Part 2.

Witnessing the coal-cutting machines in operation on the underground seams.

On two occasions I went 2,400 feet underground at the Auguste Victoria Colliery, 25 miles from Essen. The mine extracts about 1.6 million tons of coal per year. It uses eleven Eickhoff coal-cutting machines, 10 being chain machines, and 1 being a drum machine. The seam thickness varies from 2 ft. to 11 ft. The coal has 32% volatile, and in hardness and structure is said by Mr. Tiefengraber to be very much like Minto coal.

On my first visit I saw the drum machine cutting a 7 ft. thick seam, 5 ft. being coal, 2 ft. being dirt. This machine is 30 inches in diameter (larger than the one proposed for Minto). It was cutting along a face 700 ft.

in length, making a cutting trip this length and a return loading trip in 3 hours total, advancing the cutting face 2 ft. 2 inches. It made three round trips per day in two shifts (16 hours), so advancing into the long face 6½ ft. per day.

On another visit to this mine I saw a chain machine cutting along a 880 ft. long face. The complete face of that length was cut into 4 ft. during one shift. The seam varied in thickness from 21" to 31", average being 27½.

Both the drum and chain machines were delivering the coal to the 2 ft. wide steel trough conveyors on which they rode.

I was very much impressed by the action of both machines: their vigour, strength and ruggedness. There is undoubtedly a great deal of high grade engineering development behind them.

Part 3.

Inspecting the manufacturing and construction of the coal cutting machines in the factory of Eickhoff Company in Bochum.

I went all through the plant of Eickhoff inspecting the various processes, and the plant lay-out. 1,500 workers are employed. The company is about 100 years old, and has been engaged for a long time in developing and improving coal cutting machines.

I elicited the following information from their executives and engineers, some of whom accompanied me to the different places I investigated in the Ruhr:-

	Number of Eickhoff coal-cutting machines now in operation.	
	Chain type	Drum type
In the Ruhr	315	35
In Czechoslovakia	85	15
In Great Britain	-	18
In Yugoslavia	2	1

They also told me that about 100 chain type machines that were put in before and during the war are still working· that 8 to 10 years is the usual life of chain machines, and that yearly maintenance costs are about 10% of first cost.

I was most favourably impressed by the Eickhoff factory and people. The factory is of high grade in its layout and manufacturing methods. The engineers and executives are very able men. The factory and the people are on a par with the best one would encounter in a good American plant.

Part 4.

Inspecting the manufacturing, construction and testing of the [illegible] props and roof bars in the factory of Wanheim company in Duisburg.

Steel props and roof bars are an essential feature of the mines I examined, and are proposed by Mr. Franz Tiefengraber for Minto, as being cheaper than wood props. He recommends those made by Wanheim, whose factory I visited. In their laboratory I witnessed props being tested by hydraulic loads with over 35 tons load, and still with much more resistance in them. The factory, in its lay-out and methods, is of high class· the design and construction of the props and bars are carried out on good and ingenious engineering principles.

For an initial experiment in Minto, Mr. Tiefengraber proposes to use 275 separate props, and 275 combined props in which the roof bars are hinged to the props.

Part 5.

Quotation on Equipment for Minto demonstration.

At a conference with the Stahl Union, at Dusseldorf, an itemized quotation was prepared of the equipment that Mr. Tiefengraber listed as

necessary for a demonstration by him in Minto. Stahl Union is the export agency of the Eickhoff and Wanheim firms - and others. Besides Mr. Tiefengraber and myself at the conference were representatives of Eickhoff, Wanheim and Stahl Union. Quotation decided on, as follows:

		F.O.B. Minto
1 coal cutter (chain type S II)		$18,571
1 300' conveyor		16,695
Electric equipment		3,573
275 Combined props		10,433.50
275 Separate props		8,615.75
275 Bars		8,324.25
Total - including freight, duty, Federal Sales Tax:		$66,215.50
Additional (at Mr. Tiefengraber's request):-		
Loading panzer conveyor, say		$ 7,000
Electric equipment - drive, controls and cables, say		1,140
Spare parts		4,000
	Total	$78,355.50

The final quotation based on the above was sent by Stahl Union to Prof. W. Y. Smith and may differ in some details from the above.

Part 6.

Discussion with Franz Tiefengraber of his July report to the N. B. Royal Coal Commission

The report shows a diagram of how Tiefengraber proposes ultimate mechanization of Minto. He would take a block 2,400 ft. x 2,400 ft., drive a 100 ft. deep shaft, and make tunnels to the long faces. When this area got exhausted he would proceed similarly on other such areas. For economy in underground transportation his long faces would be only 300 ft. The cutting machines (drum or chain) would deliver coal to the conveyor (panzer) on which they are mounted; the conveyor delivers to rubber belts which carry the coal towards the shaft. In an area 2,400 ft. x 2,400 ft. with a 2 ft. seam, the amount of coal is 400,000 tons.

Mr. Tiefengraber proposes to mine the area by drum-cutting machines (made by Eickhoff) smaller than those now in use, but the type is still being developed. Several of these small machines have been made. I saw one that had been in use for a year. Eickhoff will not be ready to guarantee it until about 8 months from now. Two such machines in Victor McMann's field would together produce 392 tons per day: that is, 100,000 tons per year of 250 days: the investment in equipment would be $173,000.00 including a third drum-cutting machine as a spare.

As a result of my investigation of the methods and machines proposed by Mr. Tiefengraber for Minto, and of my analysis of the probable economies they would accomplish, I recommend that the Royal Commission on The New Brunswick Coal Mining Industry should proceed with an experiment with those machines and engage Mr. Franz Tiefengraber for a limited period of time to supervise their operation.

APPENDIX III Statistical Table

Year	Average Output per man-day Shaft	Average Output per man-day Stripping	Cost of coal, f.o.b. cars, Minto
1948	1.5	5.0	$6.23
1949	1.5	4.3	6.67
1950	1.5	4.1	7.03
1951	1.5	5.0	6.93
1952	1.6	4.8	6.26
1953	1.6	4.5	6.67
1954	1.5	4.9	6.72
1955	1.5	5.2	6.68
1956	1.6	5.3	6.96
1957	1.8	5.6	7.15
1958	1.7	5.2	7.52
1959	1.8	5.4	Not available